ELECTRICAL REVIEW

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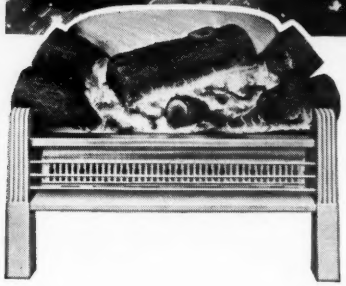

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ELECTRICAL REVIEW 9th JANUARY, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLII • NO. 2

Power Plant Position

BY commissioning generating sets in 1952 with an output capacity of 1,539 MW the British Electricity Authority greatly exceeded the record of 1,113 MW set up in 1951. It is more to the point, however, that last year's figure is appreciably above the 1,400 MW which was planned as a maximum for the period. Taken together with the lesser capacity aimed at (though not fully attained) for 1951 of 1,250 MW, the total of 2,650 MW planned for the two years has been reached—a great manufacturing feat, worthily supplemented by the efforts of constructional engineers.

Particulars of the new plant are given on another page. These show that seven of the thirty-two stations in which this plant was installed are entirely new constructions. They contain, initially, nine turbo-alternators of seven makes, mostly of 52 to 60 MW, with Barking " C " (75 MW) and Huncoats (30 MW) as exceptions at each end. The capacity of the twenty-five sets in the same number of previously commissioned stations ranges from 30 to 60 MW. Steam is raised in fifty-nine boilers in all, of nine makes, with an aggregate evaporative capacity of 16,985,000 lb/hr. Only thirteen are rated at less than 200,000 lb/hr; one at Keadby has a capacity of 550,000 lb/hr, the same as its fellow installed there last year, which is the largest so far in this country; two at Battersea " B " are rated at 425,000 lb/hr. The main high pressure pipework was provided by five firms.

The plant in this programme follows generally the advanced lines of that which is already rendering good service and producing thermal efficiencies, on kWh sent out, of nearly 30 per cent. Further improvement in this respect is to be looked for when the sets of larger capacity with the higher steam conditions proposed for later annual programmes of the B.E.A. become available. The target for the coming year is 1,500 kW and if commissioning can be kept in line with planning in this and subsequent years there should be a further material saving in fuel and maintenance costs through the

closing down of obsolete plant. This will depend upon the availability of the requisite steel and other materials. There remains, however, the question of whether the B.E.A.'s plans for the future are sufficiently ambitious. Load trends over recent years suggest that Col. B. H. Leeson's view that 2,000 MW per annum should be provided is nearer the mark than the B.E.A. figures of 1,600 to 1,800 MW in 1956 and thereafter and certainly very much nearer reality than the 1,550 MW prescribed by the Government.

SPURIOUS ACCURACY

When dealing with figures in bulk, minor inaccuracies tend to be cancelled out in the total and so are likely to represent aggregate conditions closely enough. When considering individual instances, however, an apparent claim to exactness by the expression of results in more significant figures than are realistic may be seriously misleading. This is especially the case in insulation measurement, as Dr. J. S. Forrest showed in his lecture to the E.P.E.A., which is reported in this issue. The great variations found in breakdown tests and the effects of changes in temperature and of possible polarization and absorption are particularly notable and may make several-fold differences in results.

ATOMIC ENERGY

An enormous advance has been made in the nuclear sciences through the development of the atomic bomb, but "security" has prevented the dissemination of the knowledge gained. Such occasions as the symposium at the I.E.E. this week are therefore greatly to be welcomed. Nevertheless, the veil is still too thick to enable a forecast to be made of the time when our electric power supply will be derived from nuclear fission. In the meantime it may be considered rather odd by those who have accepted the electronic theory of electricity that there should have to be a double process of producing heat by nuclear fission and using that heat in the same way as that derived from coal to produce electricity.

"FREED" APPLIANCES

The Order releasing manufacturers of certain domestic electrical appliances from the obligation to obtain licences for the production of these appliances does not appear to mean much. While anybody is now free to make the appliances it will still be necessary to obtain the materials first—not always an easy matter. In any event restrictive purchase tax, combined with other adverse circumstances, has resulted in the supply position being equal to or greater than the demand. It is therefore these other factors which have to be contended with if there is to be any improvement in the manufacturers' prospects.

I.E.E. BENEVOLENT FUND

Individual benevolence is attended by many difficulties and to be effective in a particular case may call for more assistance than a single individual can render. But all I.E.E. members, even those with modest incomes, should derive personal satisfaction from helping by subscribing to the Institution's Benevolent Fund which is dispensed with sympathy and discretion. In the appeal for support which it is customary for the President to make at the beginning of each year Col. Leeson expresses an earnest hope that members will, whenever possible, covenant their subscriptions because of the great additional benefit this brings to the Fund. Notwithstanding the Institution's increased membership the amount of subscriptions and donations has decreased (two-thirds do not at present subscribe) while the demands made on the resources of the Fund are likely to grow still more in the near future.

Large Office Scheme

Electrical Arrangements at Ministry of National Insurance Headquarters

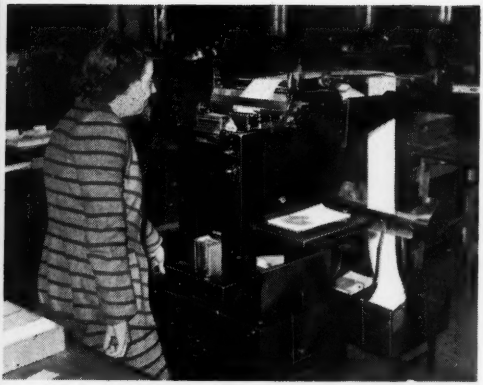
STANDING on a 62 acre site and comprising sixteen main blocks with two large dining halls and three boiler houses, the Ministry of National Insurance offices at Benton, Newcastle-on-Tyne, are believed to be the largest block of offices in Europe. Extensive mechanization of operations, together with lighting, heating and water heating services, has created a demand for electricity amounting to about 700 kW, with an annual consumption of up to 1¼ million kWh.

No fewer than 400 electrically operated machines have been provided for the records departments for card punching, tabulating, sorting, analysing, accounting, etc. In one room alone we saw 111 key punching machines each driven by an ⅛ h.p. Croydon motor. Another striking feature is the Lamson tube installation used for distributing and collecting correspondence, records, etc., between the various blocks. There are two separate systems each covering approximately half the site and between them comprising about eight miles of 4in tube, the longest tube being about ¼ mile. The tubes run either in a brick tunnel or in an underground duct. The carriers, of which two types are used, 8½in and 13in long, travel at approximately 20 m.p.h.

Two exhauster houses have been provided in connection with this system. In the larger, two Lamson turbo-exhausters have been arranged in duplicate with their Brook 35 h.p. motors controlled by E.A.C. starters. The other exhauster house accommodates two 15 h.p. units. For transporting

Above: **Louvred fluorescent lighting fittings are employed in many of the records rooms to give high intensity illumination**

Right: **There are about 400 electrically-driven office machines in use. Here are some of the 111 key punching machines in one department**



A punched card tabulator

bulky or heavy articles which cannot be handled by the tubes, there are two Ransomes electric trucks complete with "Westalite" charging units.

Fluorescent lighting, using either plain or louvred fittings (F. H. Pride, Ltd.), has been employed extensively for the general illumination of many of the office blocks and altogether 1,525 80 W 5ft tubes have been installed. In addition there are about 8,000 tungsten lamps, many of which are arranged for local lighting. As a rule in the machine rooms general lighting from Benjamin "Crysteel" reflector units is supplemented by adjustable fittings (which were made up on site) over the machines. A road lighting system comprises 56 Stanton concrete standards fitted with 150 W tungsten lamps.

Hot water for heating the buildings and for "domestic" supplies comes from three separate boiler houses at strategic points on the site. In the largest (No. 3) the plant comprises three Lamont water tube high pressure hot water boilers of 10 million B.Th.U./hr capacity made by the Ivor Power Speciality Co., Ltd. Two of these boilers are sufficient to operate the heating plant, the third being kept as a stand-by. Ancillary plant consists of Hodgkinson mechanical stokers (1½ h.p. motors), "Sirocco" forced and induced draught fans (12½ h.p. and 1 h.p.), coal handling plant (5 h.p. and 3½ h.p. motors for elevator and scraper), feed pumps (4 h.p.) and circulating pumps (20 h.p.).

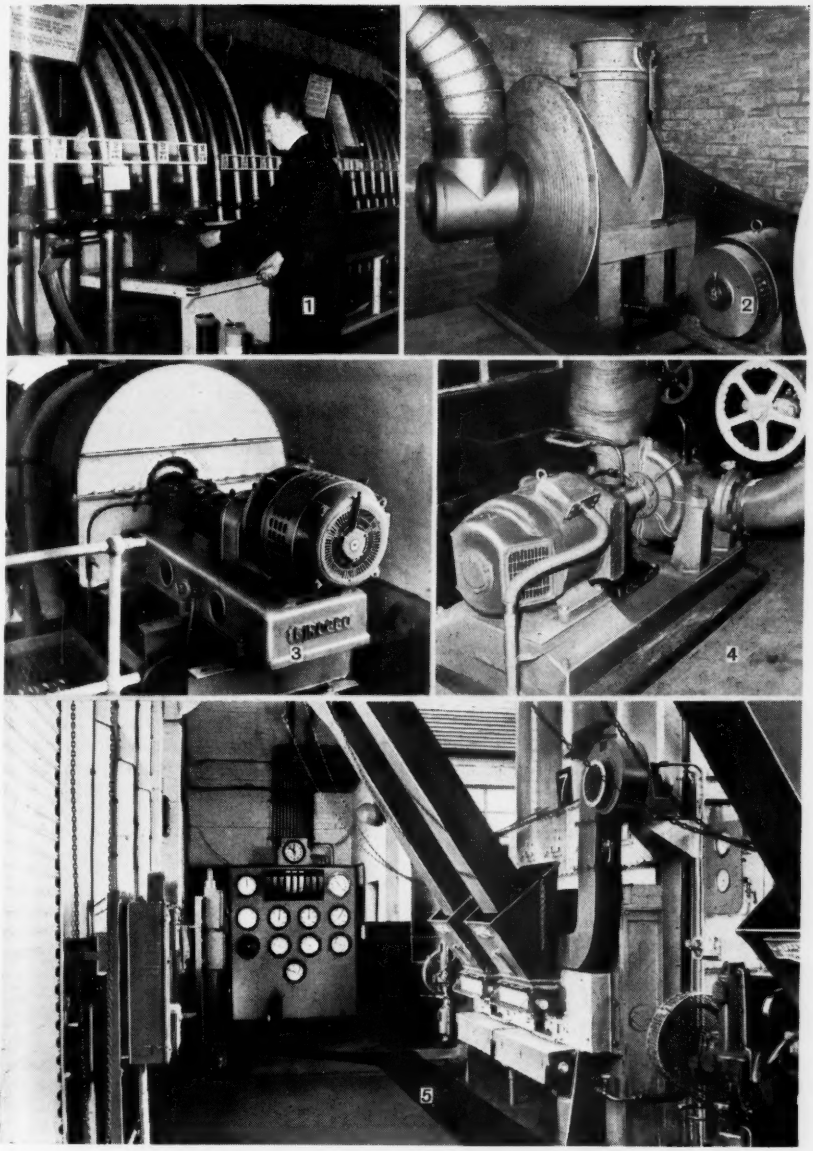
E.A.C. controls, together with Crabtree 3-speed switches, are provided for the stokers and the induced draught fans which are driven through Croft 1·25 : 1 gear units. Allen West starters control secondary air fans, the "Mopump" feed pumps, Holden & Brooke high pressure circulating pumps for passing the hot water to the eighteen calorifier rooms, and also a compressor for blowing out the water tubes of the boiler. Various makes of motor are used in this installation.

An Electroflo instrument panel shows at a glance the operating conditions throughout the heating system, dials indicating flow and return temperatures, the temperature in the boiler drum, flue gas temperature, outside air temperature, CO_2 and air pressure. The electricity supply to the boiler room is received from a Reyrolle 150 A feeder pillar. Two Simplex 60 A and one Cantie 30 A distribution boards are provided for local supplies.

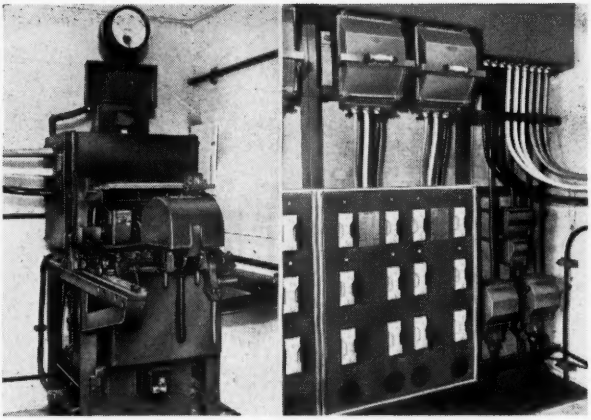
In each of the smaller boiler houses there are three Foster, Yates and Thom "Economic" boilers with Doby ram stokers. "Dupar," E.A.C. and Holmes (Altrincham) panels respectively control the stokers (½ h.p. motor) and forced draught (16 h.p.) and induced draught fans (3 h.p.). As in the larger boiler house the "Mopump" feed pumps are driven by 4 h.p. motors, but the circulating pumps require only 11 h.p. machines. The instrument panels here were supplied by Bailey Meters & Controls, Ltd.

Temperature in the various buildings is controlled by means of thermostats on the roof operating in conjunction with Honeywell & Brown controllers, time switches and motor-operated valves in the calorifier rooms, where are also installed the Holden & Brooke pumps (Brook 1 h.p. motors) for circulating the hot water from the calorifiers through the radiator system, and Frederick A. Pullen & Co.'s pumps (Brook "Cub" motors) for the domestic hot water service. Control of these pumps is by E.A.C. "Autoswitches."

Although electricity is not used for cooking, the kitchens serving the dining halls are extensively equipped with such electrically operated labour-saving appliances as Hobart mixers, Asco bread slicers, Crypto potato peelers, Peerless chipping machines and Euk dishwashing machines. For food storage there are two "Prestcold" 376 cu ft coldrooms, one B.A.R. and one "Prestcold" refrigerators, and an Eldorado



(1) Main distribution centre of the pneumatic tube system. (2) One of the duplicate 35 h.p. turbo-exhauster plants used for the pneumatic tube system. (3) Induced draught fan with 12½ h.p. motor for one of the water tube boilers. (4) 20 h.p. motor driving a circulating pump for the heating system. (5) One of three Lamont water tube boilers equipped with electrically operated stokers, forced and induced draught fans and coal handling plant



Left: **Reyrolle 1,000 A main switch controlling the supply to the offices.** *Right:* **Part of triple-pole busbar chamber with air break switches and h.r.c. fuses through which the supplies are distributed to local feeder pillars on site**

ice cream conservator. Fumes are removed by means of extract fans. Gent electric clocks and a G.E.C. public address system are installed throughout the office blocks.

The electricity supply for the scheme is received from the North Eastern Electricity Board through a brick substation incorporated in the layout of the buildings. This substation, which is fed by two 6 kV feeders, is provided with a Parsons 1,000 kVA 5,500/440/250 V transformer with tappings of plus and minus 3 per cent and 6 per cent. The l.v. supply, controlled by a Reyrolle 1,000 A oil immersed switch (33 MVA rupturing capacity), is taken through a Henley triple-pole busbar chamber to four underground ring mains controlled by Artic 300 A triple-pole air break switches and 300 A h.r.c. fuses in t.p. and n. tailless units to nine feeder pillars on site. The ring main cables are 4 core 0·3 sq in and 0·25 sq in.

From the 300 A ring units in the feeder pillars are fed the switch and meter rooms in each block. Here with a Cantie or Simplex 150 A main switch is a Simplex distribution board. In some cases, too, a transformer, which steps down the supply to 200 V, has been installed for certain of the machines. Should there be a failure of the main supply a change-over switch enables a supply to be taken from emergency generating plant comprising four 22·5 kW mobile generating sets driven by Ford V 8 engines and one 16·7 kW diesel generator. Throughout the installation the wiring has been carried out in screwed conduit.

The electrical installation was undertaken by the Berkeley Electrical Engineering Co., Ltd., and Matthew Hall & Co., Ltd., and the heating installation by Z. D. Berry. The cabling was done by the Power Lines Construction Co., Ltd. Inductive Appliances, Ltd., supplied the control equipment for the fluorescent lighting fittings.

We thank the staffs of the Ministry of National Insurance, the Ministry of Works and the North Eastern Electricity Board for their help in preparing this article.

Domestic Appliance Market in Libya

IN his report on economic and commercial conditions in Libya (H.M. Stationery Office, 1s 9d net) Mr. H. J. Legg, formerly First Secretary (Commercial), H.M. Legation in Libya, says that by reason of the mode of life of the greater part of the population, there is only a very small demand for household equipment. Kitchen utensils for the local population are made by native metalworkers on a home industry basis, but goods for the better quality trade are imported. Refrigerators and all domestic electrical appliances are imported and form an appreciable part of the total imports of household equipment. Consumption of electricity is constantly expanding and can be expected to provide an increasing demand for all kinds of basic electrical supplies for wiring, insulation, etc. The cost of electricity, however, is relatively high and this tends to limit the demand for appliances for households and small "home" industries.

The future for heavy electrical equipment rests on the extent to which industry may be established and there is no early prospect of there being an appreciable market for this type of equipment.

Staffing for Productivity

Choosing and Keeping the Right Men

By VERNON CLEMENTS
M.I.E.E.*

A "Productivity Campaign" was well and truly launched at the end of October by the British Electrical Development Association. No one imagines that the mission of productivity is anything new to the electricity supply industry; its traditions go back to the first uses of the electric motor and were developed by the larger companies and municipalities right up to the outbreak of the 1939–45 war. What is perhaps forgotten is that the mission was long-term and that quick results were, and always will be, out of the question.

Staff who understand the intricacies of the needs of industrialists as fully as they do those of their own business of supplying electricity are scarce; what is more, they are now largely dispersed among the various posts created under nationalization which, although important, do not call for the same special knowledge. To collect these men together again and to get them to work together as a team within the new organizations will be far from easy but less difficult than the training of new men for a job in which experience counts so highly. The number required by each Area Board will depend upon the characteristics of the Board's territory but, in any event, it should in no case be high. Including a certain amount of "double banking," about 24 men should be the maximum requirement while the minimum would be, perhaps, a quarter of that number.

Wherever they are stationed, this staff should be essentially "headquarters men" available for specific jobs in each Sub-Area and entitled to go into each Sub-Area or District at will. In this the tact, friendliness and good fellowship which always existed in the large organizations of the past will be of paramount importance; not only will it clear away artificial barriers, but it will engender, for and from the Sub-Areas or Districts, the respect that is an absolute essential.

Commercial engineers outside headquarters cannot expect to be specialists but they must know their industrial consumers personally. For the most part, the "hunches" that lead to positive action must come from the commercial engineers and be passed to the specialist who would come in as a kind of consultant to both the commercial engineer and the industrialist, with direct access to the latter when necessary. This matter of personal relations is vital as without it the whole campaign can fail.

It is futile to require that even the specialist staff should have detailed knowledge of all aspects of all industrial processes. The staff must, however, understand those aspects and be able to converse about them in the language or jargon of the industry concerned. They must know where to look for the points which need their help and they must know what firms of manufacturers are available, when necessary, to assist in the planning and provision of any new plant needed. To do this they must keep closely in touch with manufacturers of electrical and mechanical plant so as to be familiar with the latest devices for improving productivity and with those who are best fitted to be called in to deal with the particular case.

It would be a mistake to include in the specialist staff those whose knowledge is chiefly in the contracting field or who originate from the sales side, unless they have other qualifications. When a cabling layout is needed the Board's own contracting staff, or outside contractors, are always available for guidance; too great an emphasis on selling would impair the industrialist's confidence that advice was given willingly even though no extra sales resulted.

When recruits to the specialist staff are

* Mr. Clements is Assistant Commercial Manager, British Electricity Authority

necessary, it will be best to look either among the large body of bright young engineers for those who will not wilt under several years of special training or among men experienced in industry who will need training, at least in the tariff aspects of electricity supply.

A staff for productivity will not be able to give of their best if hamstrung by a too-rigid tariff system. Many of the now-established processes started as working experiments in an enlightened manufacturer's works with tariffs which had to be "invented" by an equally enlightened electricity undertaking so as to give a reasonable chance of success. Shipyard welding, for example, was developed in this way by the active co-operation of a well-known shipbuilding company and a large electricity supply company, as also was large-scale electric baking. Still longer ago, the manufacture of fused silica products was developed on similar lines and to-day forms a substantial industry catering for the chemical and allied trades. Perhaps the electricity supply industry has moved too far from the days when electricity for coal winding was charged not at a price per kWh but at so much "per ton of coal raised." Standard tariffs no doubt introduce difficulties in negotiation but as Mr. Churchill has said, in quite another context, "The difficulties will argue for themselves."

Having gathered together the staff for productivity, the job they are to do must be given both the status and responsibilities which the subject demands. Their leader, at least, will need to be able to meet managing directors and the like on equal terms. It is no use a senior man writing to the managing director of a firm but having to have his letter signed by somebody else—nor with his own name over some title which does not signify a high degree of importance. No staff is going to be kept together for long as a team if it is not made to feel proud of its job and does not receive the rewards, both in money and in prestige, which it earns. Staff of the type needed for productivity are of a calibre which is much sought after for other jobs both inside and outside the supply industry.

Engineering in Europe

Survey of Current Literature

VARIOUS kinds of plastics are affected by tracking phenomena; not only does the incidence of tracking differ but, even more important, the results of the attack differ qualitatively. Phenolics form branched carbonized tracks of greatly increased conductivity, whereas urea and melamine plastics form small cavities at right angles to the field direction, which makes them much more resistant to tracking. At any rate the tracking phenomenon itself can only develop in the presence of moisture, and testing methods for insulants must therefore be based on the deposition of a well-defined and reproducible quantity (drop) of a standardized electrolyte before the electric field is applied between a pair of standard electrodes.

After many unsuccessful attempts, the A.S.E. seem now to have solved this problem by designing an automatic drop-depositing apparatus by which the drop volume may be accurately regulated down to 15 mm^3 (drop diameter 3·06 mm). This device is combined with the pin-ring electrode arrangement standardized by the British Admiralty regulations and the electrolyte used is a $\frac{1}{4}$ per cent Nekal solution. A very distinct differentiation between the tested plastics is possible according to (1) whether or not they catch fire, and after deposition of how many drops; (2) what alterations of the material are noticeable after the test, i.e., deep cavitation or slight pitting, or even mere discoloration (since the best materials are not carbonized).

The article under review describes the method and gives characteristic examples of results obtained on representative

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates. —Editors, *Electrical Review*

samples of the three principal groups of plastics.—" The Drop-Method of Testing the Tracking Resistance of Insulating Materials," W. Woebcken, *Kunststoffe*, Vol. 42, No. 9, pp. 253–256, September, 1952, in German.

Grouped Power Line Conductors

A comparison was carried out between 35 kV lines with 1, 2 and 3 conductors per phase and 110 kV lines with one and two conductors per phase. The supports were of wood and of the small-suspension-angle type. It was found that for newly erected lines the use of grouped conductors is not to be recommended because it reduces the reliability of the supply and complicates the operation of the lines. The number of joints is increased by about 200 per cent, the spans have to be shortened by 12 per cent or more, spacers are necessary to prevent contact between the conductors of a single phase and the conductor sections must be smaller. Thus the capital outlay increases considerably without yielding anything like comparable returns. Matters become even worse for the climatic regions 3 and 4 of the U.S.S.R., because the spans have in those regions to be shortened by 25–30 per cent. An advantage can be obtained from grouped conductors only in special cases, for example, on long lines with comparatively few operating hours and fairly steady loading where a subsequently increasing power demand can be satisfied economically by adding a second phase conductor to the original single conductor. —" Use of Grouped Conductors on 35 and 110 kV Transmission Lines," V. V. Ovseenko, *Elektricheskie Stantsii*, No. 8, pp. 32–34, 1952, in Russian.

Arcs in Inert Gases

Experiments were made with a view to revealing the causes of the instability of the high-pressure discharge in inert gases and to analysing the factors influencing the form of the arc. A cathodic gas jet was found to have a great influence on an arc burning freely. Such a gas jet originates in the roughly spherical zone of the arc column adjacent to the cathode in which the discharge plasma is produced by thermal ionization. In this section of the arc the brightness is 11 times, the energy concentration 40 times and the gas temperature 1·25 times higher than in the column proper. Variation of the conditions of the gas jet, lift and convection, mainly obtained by varying the electrode configuration, yields different forms of arc with greatly differing stabilities of the discharge. For example, it is possible to obtain a perfectly steady xenon high-pressure arc of a brightness up to 275,000 cd/cm^2.—" The Form of the Arc in the High-Pressure Discharge in Inert Gases," K. Larche, *Zeitschr. für Physik*, Vol. 132, No. 5, pp. 544–552 (1952), in German.

Tracking Test

The results of the tracking test methods regarded as most reliable do not seem to represent criteria of the performance of some insulating materials under service conditions, since cases have occurred of breakdown of materials of which the test results had been highly satisfactory. Particularly tests at 300 V do not seem to be any guarantee for the tracking resistance of the material at higher, and alternating, stresses. Kraft-paper and other fibrous or glued substances seem to develop into inhomogeneous materials with carbon inclusions whose dielectric strength may change from good to bad in a very short time under thermal stresses and surface discharges.

A manufacturing firm has evolved a laboratory test instrument for repeated stress-testing in which short-duration discharges are applied to the specimen, quenched and reignited, the test cycles being applied to dry and wet specimens. The test voltage is 2,500 V a.c. applied at intervals of 1–1·5 sec. Only urea-asbestos, melamine and alkyd plastics can stand more than 2,000 discharges before tracking occurs, plexiglass being the next best with about 1,500 discharges. The application of the test voltage of 2,500 V must not be regarded as a h.v. test (corresponding to the U.S.A. or Micafil methods), but as merely initiating a short-duration l.v. arc across the specimen which is thereby put under thermal stresses and surface stresses resulting in track-formation after a shorter or longer time. This method, particularly when combined with drop-deposition, comes nearest of all the methods so far suggested to simulating service-stressing.—" The Practical Point of View of Tests of the Tracking Resistance of Plastic Insulating Materials," E. Berg, *Kunststoff*, Vol. 42, No. 9, pp. 257–260, September, 1952, in German.

PRINTED CIRCUITS

Methods and Applications

By R. H. WARRING

DURING the war a new technique grew up for the production of very small, compact electrical circuits which, by reason of the methods involved, became known as "printed circuits." Instead of conventional wiring, electric conducting circuits were produced using a colloidal silver ink as the conducting medium, drawn or printed on a suitable base. From the beginning it was evident that not only conducting lines or "wires" could be reproduced in this manner, but resistances, condensers, chokes, small induction coils, and so on, could be drawn or printed right in the circuit, rather than manufactured as separate items to be incorporated in the circuit at a later date.

The advantages of such a system are obvious. It is particularly useful where compactness is essential and where it is necessary to produce large numbers of such compact circuits quickly. It is not, however, necessarily a cheap process, in spite of the apparent saving in labour costs.

Original Process

The original colloidal silver ink printed circuit method was brought to a practical state of development in America during the last war where it was widely used for the electronic circuits in proximity fuses. The basis of the method is that the circuit is first drawn out and a stencil made. This is then used to transfer the circuit in colloidal silver ink on to a ceramic wafer, which is then fired at a high temperature to ensure good adhesion of the metallic ink circuit and to ensure good conductivity. The costs of this method are high.

In the commercial world there are other serious drawbacks to this type of printed circuit. The high firing temperature necessary to "condition" the wafer strictly limits the type of ceramic material which can be used. Unless the physical size of the wafer is small its weight and fragility can render it impractical. There are also limits to the physical patterns which can be produced by stencilling, in particular making it difficult to hold very close electrical tolerances over a large number of production units. The fact that printed circuits have become an attractive proposition for industry is due largely to the development of alternative methods which do not show the same failings. In other words, although silver ink printed circuits showed what could be done initially, the method has largely been superseded.

Later Variants

The term "printed circuit" remains as descriptive of all methods directed to the same ends as the original drawn "ink" process, although in many cases it is really a misnomer. All the methods have one thing in common, the reproduction of a metallic circuit on a suitable insulating base. In some, however, the conducting part of the circuit is stamped out of sheet metal (which cannot truly be termed "printing"). In others it is moulded or sintered from metal powders or the circuit is stamped or impressed in the base and then "filled" with a suitable metallic conductor.

Almost certainly, however, the method which offers the greatest possibilities is still essentially a "printed circuit." In this the circuit is produced from rolled metal foil by printing and etching, laminated to an insulating base. Known as the "Technograph" system, it was originated by a firm of printers in 1941 and has now been developed to such a stage that it is rapidly becoming a standard method where printed circuits can be applied. Perhaps it is significant that its main industrial and military applications to date have been in the United States although it is a British development representing a considerable technical advance on contemporary American work, where the idea of printed circuits can be said to have originated. It is the United States which seems most eager to adopt etched foil circuits.

In case this tends to give a one-sided picture, however, mention must be made of the new types of strain gauges recently tested by the Saunders-Roe company, and produced by that company in collaboration with Technograph Printed Circuits, Ltd. These have aroused considerable interest throughout the aeronautical world (and, indeed, all industries in which strain gauges are employed). In all tests conducted so far etched foil strain gauges have shown themselves to be superior to wound wire strain gauges. It is possible to pass higher currents through them, thus making the gauges inherently more sensitive, with a higher signal–noise ratio; and they also remain stable in gauge factor at these higher currents.

In the United States etched foil circuits are now widely employed in the manufacture of electronic equipment for the U.S. Signal Corps, Air Material Command and the Navy Department; as well as by the General Electric Co., the Radio Corporation of America and various other large industrial concerns. There has been little comparable use of etched foil printed circuits so far on this side of the Atlantic.

The silver ink-ceramic wafer method is still used in America for printed circuits, albeit on a somewhat limited scale. Its main application at the present time is in the production of circuits for hearing aids and some experimental apparatus. In the latter respect it has the advantage that "one off" circuits can be produced comparatively easily and subjected to small modifications with the minimum of trouble.

Advantages of Etched Foil Method

One of the main drawbacks to the colloidal silver ink wafer process is its relatively high cost, especially as a production method. The choice of conductor is also strictly limited. With the etched foil method the circuit is continuous from the start and possesses adequate mechanical strength, as well as allowing a wide choice of different metal conductors associated with an even wider choice of insulating or base materials. An etched foil circuit can be formed on flexible materials such as polythene film, impregnated paper or cloth, synthetic rubber, and so on, as well as more rigid base materials.

Furthermore, if formed on a flexible base, once etched and laminated in a flat state the whole circuit can be folded or rolled up into a three-dimensional form. As a typical example, an etched foil printed circuit pattern can be folded up in pile form to produce a transformer winding, the centre of the folded pile being punched out to take the core. The individual (etched foil) coils are then formed into a series winding by welding through the base at an intermediate stage during the folding process.

For the simplest type of circuit where there are no crossing conductors a single foil sheet is used, bonded to one surface of the insulating base. In complex circuitry with crossing conductors a three-laminate "sandwich" is employed—foil/insulating-base/foil. The circuit is split, part on each side of the insulating base, and interconnected as necessary by welding or mechanical means. Simplified technique also enables other major components to be solder jointed to etched foil circuits.

The preparation of an etched foil circuit follows a number of straightforward steps. The first is the preparation of a scale drawing of the circuit (two drawings if a "sandwich" laminate is necessary) by normal drawing office methods. A printing plate, similar to an ordinary line block, exact size, is then made from this master drawing, just as a line block is made from any black and white original drawing. This printing plate or block is then used to print a pattern of the circuit on the bonded metal foil surface (or surfaces). Special inks are used, selected as best for the type of metal being printed. It is obviously very important that the printed circuit at this stage shall be perfect with a complete absence of pin-holes, etc., which might modify the characteristics of the final foil circuit when surplus metal is etched away. The ink must also be perfectly resistant to the etching solution employed since its purpose is to preserve an exact duplicate of the printing plate image on the foil when in the etching bath.

Etching Process

The process of etching follows exactly the same technique as that used in the preparation of printing blocks. Normally chemical etching is employed, although in some instances electro-etching may be advisable. After processing the etched circuit is washed and neutralized to remove all traces of etching solution and thence passed on either to store or to the next

production stage. Normally, of course, in a production line, a number of separate circuits would be prepared " as one " and parted off into individual printed circuits after the completion of the printing stage.

The foil used is relatively thin, but even so the cost of the metal may account for a considerable proportion of the total production cost of the unit circuit. In most normal circuits the quantity of metal etched away during the printing process is usually greater than the total amount of metal left forming the actual circuit. To obviate waste of this kind the used etching solution is itself processed to recover the dissolved metal in the form of further foil of any desired thickness, while the solution itself is regenerated.

For experimental circuits, where only one or two etched foil circuits are required, costs can again be reduced by eliminating the first stages of the normal printing process and transferring the circuit design immediately on to the foil prior to etching.

Assembly of Components

While the problems do not end with the production of the complete printed circuit—there is the question of connecting up other major components, for example—the etched foil circuit is about the only practical type of printed circuit which can readily be adapted to automatic or semi-automatic assembly methods during the final stages of production. The soldering of components is usually accomplished by spraying the solder through a mask or using multi-head soldering tools. With foldable circuits, all the necessary folding can be done by machines.

It will thus be appreciated that printed circuits offer the possibility of immense savings in labour costs on the production of a wide range of electrical products. Hand labour is indispensable with conventional methods of assembly, joining each of the components with separate wires, each requiring individual attention for soldering, etc.

One of the best examples of the differences between the use of an etched foil circuit and a conventional circuit, as a production item, is afforded by the Technograph Company's description of its system as applied to the construction of an automatic telephone exchange. Here the uniselectors each have 200 contacts and most of the other two-motion switches 220 contacts each. In an exchange these switches are arranged in banks on racks. On any one bank each contact on every switch is connected to the related contact on all the other switches on that level, calling for an extremely complicated cable form and thousands of wires to be connected individually by soldering. The necessary form or wiring pattern could be produced as an etched foil circuit bonded to a flexible insulating base, terminating exactly as required and doing away with the hand methods now used in preparing the cable form.

The etched foil pattern, cut to required length, could be fed through a welding head assembly to weld or solder 22 contacts simultaneously to the printed circuit, moving on to the next switch position for a further set of contacts to be welded in place, and so on. This has eliminated the manual work associated with soldering individual wires from the cable form to each of the switch contacts.

The next stage, under the Technograph system, would be to fit insulated spacing pieces to the strip and then fold the strip along its longitudinal axis. Laying one folded strip on top of another would build up the switch and complete the wiring circuit. The switch, in other words, is prefabricated to the extent of being " wired up " *before* assembly whereas with conventional methods the switch is first assembled before any wiring up can be attempted.

Scope for Application

The future possibilities of printed circuits seem most attractive. They still have their limitations in that they cannot be used to replace each and every kind of production circuit now in use. But in very many cases they offer the possibility of doing away with wired circuits and so introduce economies. The etched foil circuit, at least, offers great savings in production costs in many applications. In others it may even improve design features.

I.E.E. Summer Meeting

THE Summer Meeting of the Institution of Electrical Engineers is to take place within the area of the North-Eastern Centre. It will commence with an evening function on Monday, 29th June and officially end with the evening function on Thursday, 2nd July, but will continue on the Friday, 3rd July for participants wishing to stay for a further day.

Versatile Rack System

A Valuable Aid in Developing New Products

By R. A. LAMBERT, M.A. (Cantab.) and D. HALLIDAY

IN light electrical engineering the launching of a new design usually involves the following stages:—

1. Drawing up a specification or target of performance.

2. Deciding upon the components and circuitry which are likely to meet the specification.

3. Assembling and wiring the components in an experimental form.

4. Testing the " hook-up " and modifying it where necessary.

5. Building a prototype as similar as possible to what is visualized for production.

6. Preparing, on the basis of the prototype, full production drawings.

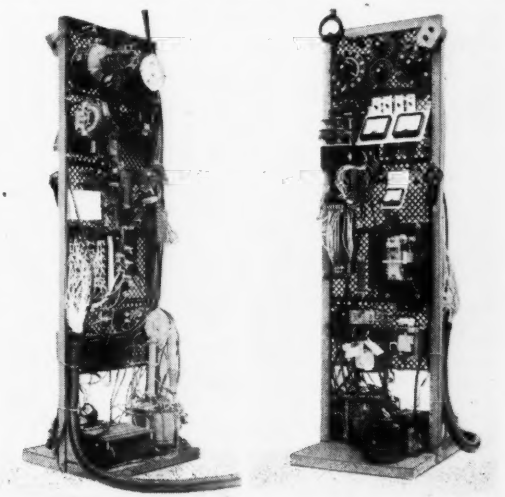
7. " Fathering " a small pre-production batch before full production is finally commenced.

Depending upon the nature and complexity of the apparatus, these stages may be divided up into a larger number or on the other hand they may be combined into only two or three.

Where a fair degree of complexity is involved, stages 2 to 5 are likely to make great demands upon the development department, both as regards the engineering staff and the workshop, and the pre-production series may present some difficulties. The crux of the matter is often to be found in the method adopted in dealing with the experimental stages. The more flexible the arrangement of the " hook-up," the easier it is to build it up and to modify it, so that less time needs to be spent in deciding upon components and circuitry for any errors of judgment here can easily be rectified.

Furthermore, before the prototype is commenced, every conceivable electrical test can be applied to the actual components and circuitry which are to be used in it (and hence in production), since there is no difficulty in incorporating in the " hook-up " *all* necessary modifications, including those arising from changes in the specification. Alterations to the prototype, often difficult and costly, are therefore reduced to negligible proportions, and the preparation of production drawings can proceed concurrently with the building of the prototype.

In the absence of a flexible form of " hook-up," much time is spent in selecting



Rear and front views of a control unit " hook-up " for a high-power diagnostic X-ray unit

components and circuits in an endeavour to reduce modifications at the experimental stage and the inevitable alterations are usually confined to absolute essentials, leaving desirable changes to be incorporated in the prototype. Final tests of the design must then be left for the completion of the prototype, with the result that costly alterations are often needed and some may extend to the pre-production batch, thus increasing the work of " fathering " them.

The system to be described is so flexible that scarcely any workshop effort is needed in assembling and wiring, so that alterations can readily be made. It has been used for about two years in connection with X-ray apparatus, the control equipment of which is often complex.

The components are mounted on steel panels which can be attached to open type racks. The panels are perforated all over with $\frac{1}{4}$in square holes arranged diagonally, leaving a $\frac{3}{32}$in network. This pattern was selected with a view to ensuring adequate hole size to accommodate bolts, spindles, etc.; adequate hole space-factor to accommodate multiple fixings at random centres; and adequate strength. A great variety of components can be fitted without difficulty, large washers with small holes being used for small screws. Ceramic insulating bushes with suitable bosses and counterbores are used for mounting live parts. Spacers and pillars are extensively employed. Provision is made for bolting panels together, so that they can be removed from the racks without disturbing components or wiring, and set aside if desired while the racks are used for other purposes.

By this method, the whole of the control gear is assembled, wired and tested, leaving nothing to chance, so that the prototype is given a " flying start." When all tests have been completed, the components are transferred to the prototype and the panels are ready for use on another job. Washers, spacers, etc., are kept in stock for repeated use. These racks and panels are also very useful for setting up minor experiments, temporary test gear, etc.

The illustrations show two views of a control unit for a high-powered diagnostic X-ray equipment, the flexible hose carrying all necessary connections to the high-tension transformer, rectifying equipment, X-ray tubes and accessories. Comprehensive tests, radiographic as well as electrical, can be made with this experimental gear.

Schoolboys' Own Exhibition

ONE of the principal attractions at this year's Schoolboys' Own Exhibition which closes at the Horticultural Halls, London, tomorrow (Saturday) is a complete, though miniature, television studio room provided by the British Electrical Development Association with the co-operation of Pye, Ltd., as part of its exhibit dealing with " Electronics."

Miss Elizabeth Cruft, the B.B.C.'s juvenile announcer, introduces the ten-minute programmes, in which seven boys participate in a quiz on the subject of electricity related to the home, agriculture, industry, railways and " What jobs can electricity offer me? " The programmes are transmitted on a closed circuit to six receivers in the hall, and spectators can also see into the control room. Elsewhere there are a scale model of the Pye sea television camera, now being used on board the deep diving vessel H.M.S. *Reclaim*, and a new miniature underwater camera recently developed for use by a diver working on the sea bed.

Also on the E.D.A. stand are shown industrial applications of electronics, the example chosen being the light sensitive cell for control and instrumentation. This story starts with a simple display in which a boy can interrupt a light beam to cause a signal lamp to light up and finishes with a fascinating demonstration in which light beams and " magic eyes " take the place of air guns on a " fairground rifle range " which can " shoot down " cats passing along a roof-top by selecting for size or colour via the electronic control switch.

Further applications of electronics are to be seen on the stands of the Anglo-Saxon Petroleum Co., Ltd., and the British Tanker, Ltd., where Marconi Marine equipment includes a " Radiolocator IV " radar display unit and a " Lodestone " direction finder.

Apprentices of the Telecommunications Research Establishment of the Ministry of Supply demonstrate how changes in temperatures at high altitudes are recorded and transmitted to instruments on the ground by means of radio sonde equipment. Visitors to the M.O.S. stand can also direct radar beams to explode photographers' bulbs and toy balloons, and light up neon lamps not connected to any power supply.

Insulation Measurement

Survey of Methods and Apparatus

IN a lecture delivered to the Electrical Power Engineers' Association (London Technical Group) on 5th January, Dr. J. S. Forrest (director of the B.E.A. Research Laboratories) discussed the principal methods employed in the measurement of insulation. A material, he said, was an insulator if it contained very few charged particles—ions or electrons—which were free to move through it at given temperatures. A practical conception of an insulator could be given approximately in terms of the equivalent circuit of capacitors and resistances in which R_p represented the volume or surface leakage in parallel with a series arrangement of capacitance C_x and loss resistance R_s.

Measurements could be made by applying voltage in the following ways: steadily, to determine R_p; suddenly, to obtain information about the three parameters by noting the change of current with time; at various a.c. frequencies to obtain the impedance and power factor and deduce the same parameters; at high potential to give the breakdown voltage of C_x and surface breakdown characteristics, such as tracking. In addition, the inception of discharges could be measured by methods which detected corona or high-frequency radiation.

Methods Employing D.C.

Measuring techniques could be classified in three groups. The first employed d.c. and included insulation resistance (volume and surface) by direct comparison with a standard resistance or calculated from the applied voltage and the leakage current. When measuring high resistances dielectric absorption might necessitate measurement after a lapse of usually one minute; resistance changed rapidly with temperature. With very high insulation values the resistance could be connected across a low leakage capacitor of known capacitance and the time noted for the charge (or the voltage) to fall to a certain fraction of the initial charge. A description was given of the Ayrton cross-coil ohmmeter with the Evershed modifications which led to the modern " Megger " insulation tester which was capable of measuring insulation resistances up to 50,000 megohms at 2·5 kV.

Electronic Equipment

Electronic methods were usually based on the foregoing principles but possessed improved sensitivity, the voltage across the standard resistance or capacitor being measured by a valve voltmeter of high input impedance. Such instruments were capable of measuring resistances of 100,000 megohms, and of detecting incipient high-voltage faults before breakdown. In one type measurement was made by a small cathode-ray tube instead of a milliammeter ; the instrument originally measured 19in by 14in by 8½in and weighed 60 lb. By adopting miniature valves and other components the size was reduced to 11½in by 7½in by 8in and the weight to 13½ lb.

Electronic sets had greatly extended the range of field testing. Not long ago a value of more than 100 megohms was described as " infinity "; now 5,000 megohms would be regarded as low at 132 kV. Tests should be made only when relative humidity was less than 70 per cent. Correction to a standard temperature might be required; for a typical bakelized paper insulator, for instance, a fall in temperature from 20 to 10 deg C increased the resistance three-fold and a rise from 20 to 90 deg C lowered it 700 times.

The convenience of electronic sets for dielectric absorption measurements was illustrated in the case of a 33 kV 40 MW alternator stator to which d.c. at 5 kV was applied. For sound insulation the ratio of the ten-minute to the one-minute value should be greater than two, while damp insulation gave a flatter resistance-time curve of one to one and a half, the resistance tending to decrease with voltage increase, whereas the opposite prevailed with good insulation.

For detecting moisture or impurities in oil a d.c. resistance test was sensitive and

the condition of used oil could be assessed in terms of its resistance at a given temperature.

The second group of measurements comprised those using a.c., the simplest being the ascertainment of the impedance of an insulator (a function of capacitance and leakage) by measuring the current passing through it. With small capacitance leakage current predominated and this method had been used, for example, in studying the performance of overhead line insulators in damp situations. The frequency and amplitude of the surges of which the leakage current consisted was registered automatically at 132 kV substations, indicating when insulators should be cleaned. Faulty line and bushing insulators had been located by measuring the voltage drop across any section by high impedance (e.g., electrostatic or valve) voltmeters.

Power loss was ascertained by variations of power factor with voltage or frequency, for which the accurate Schering bridge was commonly employed with a vibration galvanometer for power frequencies. An alternative was a doubly screened sensitive wattmeter. Resonance methods were suitable up to 100 Mc/s, but at the higher frequencies precautions against errors due to capacitance, inductance and resistance in the circuit leads were necessary.

Breakdown Tests

Dielectric strength, as determined by the application of high voltage, was widely employed for " withstand " tests for acceptance of new apparatus and for " breakdown " laboratory or type testing. Even with careful control of the rate of increase and the duration of the voltage, breakdown results showed a considerable spread, necessitating statistical treatment in drawing inferences, but the breakdown voltage did not vary with temperature as did other insulation characteristics (e.g., resistance and power factor).

Tracking due to progressive deterioration along a carbonized path on the insulation surface occurred at abnormally low voltages. It was difficult to measure, but a satisfactory test involved dropping salt solution on the surface between two electrodes, the number of drops providing a measure of resistance to tracking.

After discussing discharge phenomena, the lecturer dealt with the third group, impulse measurements, pointing out the importance of information from oscillograms, as impulse strength could be completely expressed only as a curve relating peak voltage with time to break down. Another important characteristic, especially in relation to transformer design, was voltage distribution in insulation on application of a voltage impulse. This was usually measured by applying a series of recurrent impulses at a relatively low voltage and recording the voltage wave at various points by a cathode-ray oscillograph.

There were many sources of inaccuracy in insulation measurement and results to more than one or two significant figures were seldom justified or required and insulation resistance measurements might well be expressed in terms of a logarithmic unit—the " logohm "; 100 ohms would be 2 logohms and 10,000 megohms would be 10 logohms.

Codes for Telephone Services

THE Council for Codes of Practice for Buildings has issued in their final forms two Codes of Practice for the provision of telephone and telegraph facilities within buildings.

C.P. 327.101, dealing with public services, describes the principal systems supplied and/or maintained by the Post Office to provide intercommunication within a building or group of buildings, and between remote buildings via the public telephone or telegraph services or via private circuits supplied by the Post Office. Advice is given on the necessary consultation at the planning stage and on the facilities available. Ten diagrams of telephone extension plans are included. Power supplies, methods of wiring and provision of the necessary structural accommodation for the equipment and wiring are dealt with. A section on maintenance is included.

C.P. 327.102, dealing with private services, describes systems other than those connected to the public system or supplied by the Post Office. Additional advice is given on the choice of materials, appliances and components. Particulars are given of telephone and teleprinter equipment and facilities available and internal and external wiring, including underground cables, are dealt with. Recommendations are made for power supplies and for the provision of the necessary structural accommodation. An appendix deals with segregation of power and telecommunication circuits.

Copies may be obtained from the British Standards Institution, 24–28, Victoria Street, London, S.W.1, price 7s 6d each, post free.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Queen's Commendations for brave conduct on the occasion of the floods in Devonshire and Somerset during August last have been announced. The names include **Mr. R. N. Freeman,** switchboard attendant, Lynmouth generating station, British Electricity Authority, and **Mr. C. H. Postles,** engineer-in-charge of Lynmouth power station. Mr. Postles continued to operate his station by diesel engines after the hydro-electric plant had been put out of action by the flooding, until the flywheels of the diesel engines began picking up water from the flooded floor.

Mr. H. M. Crellin, A.M.I.E.E., manager of the Test Department of W. T. Glover & Co., Ltd., and **Mr. C. W. Riley,** of the Cost Department, retired on 31st December, and have been presented with gifts from their colleagues by Mr. R. M. Fairfield, director and general manager.

Mr. Crellin, who has been with the company for fifty-two years, was a pioneer in the development of spark testing of rubber cables, and as a result of his work the spark testing method was incorporated in the standard specification for rubber cables (No. 7), 1939. He worked in close co-operation with the Underwriters' Laboratories, Inc., of New York, who presented him with an inscribed "sensitivity and voltage calculator unit" in 1939 "in recognition of his pioneering work in the field of standardization of spark tests of insulated wires."

Mr. Riley, with forty years' service, has been closely associated with many activities in the electric cable industry.

Mr. R. M. Fairfield, director and general manager, W. T. Glover & Co., Ltd. (centre), making a presentation to Mr. H. M. Crellin (right). On the left of the picture is Mr. C. W. Riley

Mr. A. C. Warman, M.I.E.E., M.I.Mech.E., M.Inst.F., assistant mechanical engineer (electrical), Ministry of Supply, R.O.F., Woolwich, has been appointed Assistant Director (Services Engineer), Division of Atomic Energy (Production), Capenhurst Factory, near Chester, and takes up his new appointment early in the new year. Mr. Warman received his engineering training with the B.T.H. Co., Rugby, and his technical education at Southend and Rugby Technical Schools, serving with H.M. Forces (R.E. Signals), 1917 to 1918. After nearly eight years' practical power station experience at Halifax, he joined (in 1930) the engineering staff of St. Anne's Board Mills Co., Ltd. (Branch of Imperial Tobacco Co., Ltd.), holding the position of chief electrical and assistant mechanical engineer for eighteen years. Mr. Warman has held the office of president, Bristol Engineering Association, as well as being a member of Area Committees of the I.E.E., I.Mech.E., and Ministry of Fuel and Power. He joined the engineering staff of the Ministry of Supply in 1948.

Mr. A. C. Warman

Mr. J. Stewart Robertson has been appointed assistant general manager of Babcock & Wilcox, Ltd., from 1st January. Mr. Robertson commenced his career in engineering by serving his apprenticeship with the General Electric Co., Ltd., joining Babcock & Wilcox, Ltd., in 1935. Following erection and service experience, he was on the staff of the company's Calcutta office until 1940, when he served with the London Scottish and the City of London Regiment of the Royal Fusiliers

until 1945, attaining the rank of major. Mr. Robertson represented the company in New York from 1946 until 1950 when he returned to the United Kingdom and was appointed manager of the Commonwealth Sales Department at the company's head office. The company announces that due to the integration of the trading activities of the Stirling Boiler Co., Ltd., **Mr. S. J. Whybrow** has been appointed manager of the Commonwealth Sales Department of the parent company. Mr. Whybrow joined the Stirling Boiler Co., Ltd., in 1927 and was appointed director and general manager six years ago.

Mr. C. J. Stewart, B.Sc., has been appointed acting manager of the Newcastle office of the Brush Electrical Engineering Co., Ltd. He was educated at Merchant Taylors' School, London, and from there went to University College, London, where he obtained an honours degree in electrical engineering. After wartime service in the Electrical Engineering Department of the Admiralty at Bath, he went to the English Electric Co., Ltd., Stafford, where he served a two-year student apprenticeship, afterwards joining the Plant Sales Department, where he stayed for approximately eighteen months. He then transferred to the British Thomson-Houston Co., Ltd., joining the Switchgear Sales Department at Willesden in 1949. **Mr. M. C. Blythe,** who was the former manager of the Newcastle office of the Brush Company, has sailed for Australia to take up his new appointment as sales manager of the Brush Electrical (Australia) Pty., Ltd., a member of the Brush Aboe group of companies.

Mr. C. J. Stewart

Sir Edward Appleton, F.R.S., principal and vice-chancellor of Edinburgh University, was inducted as president of the British Association for the Advancement of Science on 2nd January.

Mr. T. H. Silk, managing director of Hampson Industries, Ltd., is shortly going on an export tour of the Near and Far East, during which he will visit Beirut, Karachi, Delhi, Bangkok, Singapore and Djakarta.

Mr. W. J. Murray has retired from the chairmanship of Sharples Centrifuges, Ltd., but he will retain his seat on the board as a director. He is succeeded as chairman by the present managing director, **Mr. A. H. Keable,** M.I.Mech.E., M.I.Chem.E. **Mr. G. P. Balfour,** B.Sc., A.C.G.I., A.M.I.Chem.E., becomes managing director, and **Mr. G. J. Keady,** president of the Sharples Corporation, Philadelphia, has also joined the board of the British company.

The Council of the Institution of Mechanical Engineers has awarded the 1953 James Watt International Medal to **Sir Harry Ricardo,** B.A., LL.D., Hon.M.I.Mech.E., F.R.S., of Great Britain, for his contributions to knowledge of the fundamental principles of internal combustion engines and the application of these principles to design and development.

Mr. M. Gueilikman has been appointed a director of the Sturtevant Engineering Co., Ltd., in succession to **Mr. C. Harman Harris,** who has retired from the board. Mr. Harris joined the company in 1909 and was appointed to the board in 1942. Mr. Gueilikman has been with the company since 1915.

British Insulated Callender's Cables, Ltd., has announced the appointment, with effect from 1st January, of two branch managers in succession to Mr. R. S. Gough (Bristol) and Mr. T. R. Thomas (Cardiff), who have both retired. The new branch manager at Bristol is **Mr. T. L. Purves,** who served his electrical engineering apprenticeship with Fraser & Borthwick, Ltd., and gained his technical education at the Royal Technical College, Glasgow. In 1928 he joined the Anglo-Saxon Petroleum Co., Ltd., as an electrical engineer in the South American oilfields and a few years later returned to this country as lighting sales engineer in the south-west of England for Philips Electrical, Ltd. During the war he was with the B.B.C. Engineering Section, leaving in 1947 to join B.I.C.C. as a sales engineer with the Capacitor Division.

Mr. L. R. Greet, who has been appointed branch manager at Cardiff, was with the Cardiff Corporation until 1924 when he joined the former British Insulated Cables, Ltd. As a sales representative in Glamorgan, Monmouth and Brecon, and subsequently as chief assistant at the Cardiff branch office, he has represented the company in the electricity supply industry and in the industrial, manufacturing and commercial communities of South Wales.

Mr. T. L. Purves

Mr. L. R. Greet

Mr. **E. A. Bromfield,** a principal assistant with the Electrical Contractors' Association, has been appointed general secretary of the Association of Supervising Electrical Engineers, in succession to the late Mr. A. Brammer. Mr. Bromfield has had a wide experience of administration, negotiation, organization and public speaking. Previous appointments held by Mr. Bromfield have included the secretaryship of the senior association for the hairdressing and allied trades and a regional secretaryship with the employers' organization for the laundry industry. For a number of years he served in the legal and finance departments of municipal authorities. He was born at Chiswick in 1912 and was educated at Shrewsbury. During the last war he held a commission in the R.N.V.R.

As we were going to press last week we learned that **Mr. H. Nimmo,** chairman of the Southern Electricity Board, was about to leave hospital, and we reported to this effect. We then heard, too late, that Mr. Nimmo had had a sudden relapse which necessitated his remaining in hospital. We earnestly hope that he will soon be about again.

Mr. B. C. Westall has resigned from the managing directorship of Thomas De La Rue & Co., Ltd., but will continue as chairman. **Mr. A. G. Norman,** who has been with the company for eighteen years, has been appointed to succeed Mr. Westall as managing director.

Mr. Fitzroy Woods, M.B.E., M.I.E.E., sub-area liaison officer and Woking district manager of the South Eastern Electricity Board, has retired. Mr. Woods was formerly a director, chief engineer and general manager of the Woking Electric Supply Co., Ltd.

Mr. R. P. Browne, secretary of the Radio Industry Council, has entered the London Hospital, Whitechapel, E.1, for an orthopædic operation and has been given leave of absence for some months.

The Brush Aboe group announces that **Mr. M. Tattersfield,** A.C.A., F.C.C.S., has been appointed group controller of accounts. Mr. Tattersfield has been associated with the Owen Organization as a director and secretary of Electro-Hydraulics, Ltd., and Conveyancer Fork Trucks, Ltd., Warrington, and a director of Electro-Hydraulics (Canada), Ltd., and he has resigned these directorships to take up his new appointment.

Mr. T. E. B. Boothby, A.M.I.E.E., M.I.F., one of the founder-directors of Ewbank & Partners, Ltd., retired on 31st December, but his services will still be available to the company in a consultative capacity. To fill the vacancy created by Mr. Boothby's retirement, **Mr. G. E. Wheeler,** M.I.Mech.E., M.Inst.Pet., has been appointed a director with effect from 1st January. Before joining Ewbank & Partners in June last year, Mr. Wheeler was with the Anglo-Iranian Oil Co., Ltd., for twenty-seven years, having held the position of works manager, Abadan, and at the time of leaving their service, was manager of the engineering division, Refineries Department, London.

Sir Geoffrey Burton has been elected chairman of Blaw Knox, Ltd., in succession to the late Mr. J. Theodore Goddard.

Mr. James McKenzie, chairman and managing director of James McKenzie, Ltd., Birkenhead, has been appointed a Justice of the Peace of the borough. Mr. McKenzie is a member of the Chamber of Commerce and was last year's president of the Birkenhead Rotary Club.

Mr. J. McKenzie

Mr. A. G. E. Briggs, joint assistant managing director of the Electrical Division of Tube Investments, Ltd., who was "lent" to the Ministry of Supply to act as Deputy Controller of Supplies (Munitions Production) in 1951, has relinquished that position and resumed his duties with the company. Mr. Briggs' name appears in the New Year Honours as a knight bachelor.

A large gathering of members of the staff of **W. T. Henley's Telegraph Works Co., Ltd.,** and associated companies and their friends, attended the annual New Year service held at St. Sepulchre's, Holborn Viaduct, on 1st January, conducted by the Vicar, the Rev. G. H. Salter, M.A. The lesson was read by Sir Montague Hughman, and many other directors and senior officials of the Henley companies were present.

"Diamond H" Switches, Ltd., Chiswick, W.4, held its annual Christmas party at the Star and Garter Hotel, Kew, on 19th December. The managing director, Mr. C. A. Turner, gave a short address and during the course of the evening Mrs. Turner presented long service emblems to a number of employees. The company also held its annual children's party in the St. James' Hall, Chiswick, on 3rd January, at which some 260 children of employees attended.

Long service awards were presented to a number of employees of the **Midland Electric Manufacturing Co., Ltd.,** at social functions during the Christmas period. There were nineteen recipients of gold watches, each having completed ten years' service, bringing the total number of awards since the inception of the scheme up to 567. Each employee receiving a gold watch also becomes a

Mr. F. Waine

Mr. F. V. Vaissiere

Mr. J. S. A. Bunting

Mr. C. W. Cawte

member of the M.E.M. employees' retirement benefit fund. There is also an immediate life insurance cover for a minimum amount of £200 in the case of men and £100 for women. These benefits are secured without any contribution from the employee. There were eight recipients of illuminated certificates for the completion of twenty-one years' service, and holders enjoy a third week's holiday with pay.

The **Exeter Electric Club** held its second annual children's party on 20th December. This year Father Christmas (Mr. T. Chamberlain) arrived, with a present for each child, on a model engine complete with tender. A Punch and Judy show followed the tea, and there were games organized by the Social Committee under the chairmanship of Mr. J. Rothera. The organizing secretary was Mr. W. Hallam.

Messrs. A. Cook, M.B.E. (secretary), **N. D. Bryce** (sales development manager) and **E. A. Taylor** (commercial sales manager) have been appointed executive directors of Belling & Lee, Ltd. They have all held responsible positions in the company for over twenty years.

The annual dinner and dance of the West London Branch of the **Association of Supervising Electrical Engineers** was held at the Clarendon Restaurant, Hammersmith, on 3rd January. The principal guest of the evening was the president of the Association, Mr. C. T. Melling, and the members and guests were received by Mr. A. P. Hunt, branch chairman, and Mrs. Hunt. In the course of the speeches reference was made to the lamented death of the general secretary, Mr. A. Brammer.

Mr. F. Waine, J.P., a director of British Insulated Callender's Cables, Ltd., has been appointed chairman of the Cable Makers' Association for 1953. **Mr. F. V. Vaissiere**, general sales manager of W. T. Henley's Telegraph Works Co., Ltd., has been appointed chairman of the Mains Cable Manufacturers' Association and the Mains Cable Manufacturers' Association (Super Tension). **Mr. J. S. A. Bunting**, M.C., a director of the Edison Swan Electric Co., Ltd., has been appointed chairman of the Rubber and Thermoplastic Cable Manufacturers' Association for the second year in succession. **Mr. C. W. Cawte**, Johnson & Phillips, Ltd., has been appointed chairman of the Overseas Rubber Cable Manufacturers' Association.

Mr. R. W. Cooper, M.C., chairman of the British Aluminium Co., Ltd., resigned his directorship on 31st December. **Viscount Portal of Hungerford**, K.G., G.C.B., O.M., D.S.O., M.C., who is a director of the company, has succeeded Mr. Cooper as chairman. **Mr. E. F. O. Gascoigne** has been appointed a director of the company.

Mr. F. W. King, manager of the company's Streatham works, has been appointed to the board of Smith Meters, Ltd. Mr. King has been thirty-three years with the company, ten of them as works manager.

OBITUARY

Mr. S. H. Busch.—The death occurred in London on 2nd January of Mr. S. H. Busch, who was managing director of Asea Electric, Ltd., from 1910 until 1946, and chairman until the following year. He was in his seventieth year. Mr. Busch was prominent in the electrical industry for over three decades and he was as well-known in the Commonwealth countries as in Great Britain. The funeral service was to be held at the Golders Green Crematorium yesterday (Thursday).

The late Mr. S. H. Busch

Mr. C. W. Glass.—The death occurred at Portishead on Christmas day, at the age of sixty-seven, of Mr. Charles William Glass, who retired from service of the British Electricity Authority two years ago. He had

been associated with the development of the Portishead station, and for many years was hon. secretary of the South Western Branch of the Electrical Power Engineers' Association.

Mr. W. T. Gibson, O.B.E., M.A., B.Sc., M.I.E.E., chief valve engineer, Standard Telephones & Cables Ltd., whose death we reported in our last issue, was born in 1899 and attended Northampton Grammar School, from which he gained an open scholarship in mathematics and physics to Trinity College, Cambridge, in 1917. He served in the Royal Engineers in the 1914-18 war at the Gas Experimental Station at Porton, and was awarded the O.B.E. for his work there. Returning to the University he took first-class honours in natural sciences at Cambridge in 1921, and after a year of research in the Cavendish Laboratory under Professors J. J. Thomson and Rutherford, he joined the staff of the Western Electric Co. (later Standard Telephones & Cables, Ltd.), in 1922 for the purpose of initiating and building up the manufacture of radio valves. He also set up the valve laboratory of Le Matériel Téléphonique in Paris in 1928, and the Newark, New Jersey, valve laboratory of Federal Telephone Laboratories in 1932. Mr. Gibson was internationally known for his technical knowledge of radio valves.

Mr. A. O. Davis, for forty-seven years in charge of the Woodworking and Cabinet Making Department of J. H. Tucker & Co., Ltd., died on 27th December.

E.C.A. Liverpool Branch

THE interdependence of the electrical contracting and electricity supply industries for their mutual prosperity was the main theme of the speeches at the annual dinner of the Electrical Contractors' Association, Liverpool Branch, presided over by its chairman, Mr. R. J. Chatham, at the Exchange Hotel, on Monday.

Lord Citrine, chairman of the British Electricity Authority, who was born in Liverpool and had his first job there in a small contractor's office, asked for closer co-operation to combat the much unreasoned criticism of electricity to-day.

Emphasizing the importance of electricity in the economics of the country, Lord Citrine referred to the progress made in recent years. Since he left Liverpool in 1920, the total consumption of electricity had risen fifteen times. Domestic consumers were now using fifty-five times as much and farmers to-day were consuming nearly twice as much electricity as the whole of the 1920 domestic consumers. Generating capacity, now 15½ million kW, would reach 35 million kW by 1970. In the past few years 6½ million h.p. of extra power had been added to our resources. The Clarence Dock power station, of which Liverpool was justly proud, was only half the size of the great power stations of the future. Generating sets below 60 MW would be few and far between. There was reasoned optimism in the industry and all sections had contributed to the elevation of the living standards of the ordinary man and woman.

Referring to the anti-electricity campaign, Mr. L. C. Penwill, Director and secretary of the E.C.A., said that it was not merely the B.E.A. and the Electricity Boards that were being attacked but the whole industry. It was essential that all branches of the industry should combine to present a united front to resist the attacks.

Mr. J. Eccles, chairman of the Merseyside and North Wales Electricity Board, said that in his Board's area they had built up an understanding between the Board and the contractors on a live-and-let-live basis, everyone realizing that success was indivisible.

Other speakers were Mr. W. T. Trace, president of the E.C.A., Mr. A. V. Milton, past-chairman of the Liverpool Branch, Ald. A. Critchley, chairman of the City Lighting Committee, the Lord Mayor, Ald. A. Morrow, and Mr. F. J. M. Ormrod, president of the Liverpool Architectural Society.

B.E.P.C. Ladies' Golf

ONE feature of the British Electrical Power Convention has been the Golf Competition which players of both sexes were eligible to enter. At this year's Convention at Torquay a Ladies' Golf Competition is to be instituted and Lord Citrine has generously presented a trophy in the form of a beautiful reproduction of a William and Mary rose bowl. In accepting it the Convention Council has decided to name it "The Lady Citrine Trophy." An illustration of the bowl accompanies this note. Readers are reminded that the proceeds of the two golf competitions are handed over to the Electrical Industries Benevolent Association.

"Lady Citrine" golf trophy

New Year Honours

Electrical Men in the List

THE New Year Honours List published last week includes a number of well-known men in the electrical and allied industries, from which we have made the following selection.

SIR (ROBERT WILLIAM) HUGH O'NEILL, Bt., M.P., chairman of the Lisbon Electric Tramways, Ltd., is created a baron.

Among those upon whom knighthoods have been conferred are MR. J. BENSTEAD, C.B.E., deputy chairman, British Transport Commission, DR. H. ROXBEE COX, M.I.Mech.E., F.R.Ae.S., chief scientist, Ministry of Fuel and Power, MR. C. K. F. HAGUE, deputy chairman and managing director, Babcock & Wilcox, Ltd., MR. A. CROFT, chairman and managing director, Crofts Engineers (Holdings), Ltd., and Crofts Engineers, Ltd., and MR. A. G. E. BRIGGS, joint assistant managing director, Tube Investments, Ltd. (Electrical Division).

Dr. H. Roxbee Cox

Mr. C. K. F. Hague

Mr. A. G. E. Briggs

The EARL OF LIMERICK, K.C.B., D.S.O., T.D., chairman of Parnall (Yate), Ltd., and LORD BRABAZON have been appointed Ordinary Knights Grand Cross of the Order of the British Empire (G.B.E.).

The following become C.B.E.s:—MR. H. F. CARPENTER, former secretary of the British Electricity Authority, MR. H. A. CRUSE, director and general works manager, Westinghouse Brake & Signal Co., Ltd., MR. W. D'ARCY MADDEN, chairman and managing director, Hick, Hargreaves & Co., Ltd., MR. F. I. RAY, Regional Director, London Telecommunications Region, G.P.O., MR. J. A. SMALE, A.F.C., engineer-in-chief, Cable & Wireless, Ltd., MR. A. H. TOPHAM, joint managing director, Mawdsley's, Ltd., MR. C. J. TURNER, chief engineer, Division of Atomic Energy (Production), Risley, Ministry of Supply, MR. H. T. BENNETT, O.B.E., managing director, Marconi Telegraph Co. of Egypt, and MR. F. P. EGERTON, deputy chairman and general manager, Central Electricity Board, Federation of Malaya.

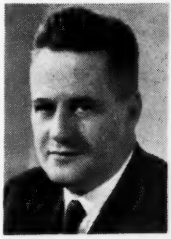
The new O.B.E.s include MR. R. L. BATLEY, controller, Midlands Division, British Electricity Authority, MR. H. G. DAVIS, chief regional engineer, North Western Region, G.P.O., MR. A. A. DYSON, managing director, Erie Resistor, Ltd., ALD. J. R. POTTS, J.P., member of the North Western Electricity Board, and MR. J. L. KING, resident engineer in London of the Electricity Corporation of Nigeria.

Mr. H. F. Carpenter

Mr. H. A. Cruse

Mr. J. A. Smale

Mr. A. H. Topham



Mr. R. L. Batley

Ald. J. R. Potts

Mr. L. A. Jouning

New Members of the Order of the British Empire (M.B.E.), are MR. F. COOTE, area engineer, Southampton, G.P.O., MR. G. W. COX, B.E.M., assistant superintendent (telecommunications), Ministry of Civil Aviation, MR. I. F. FISHER, works manager, British Timken, Ltd., MR. F. FLETCHER, sales manager, special technical productions, Coventry Telephone Works, General Electric Co., Ltd., MR. A. S. HELMS, lately generation engineer, South Eastern Division, B.E.A., MR. D. G. JONES, works cost accountant, E. K. Cole, Ltd., MR. L. A. JOUNING, works manager, Aron Electricity Meter, Ltd., MR. G. A. PARROTT, executive engineer, Telephone Manager's Office, Leicester, MR. C. H. PETFORD, personal assistant to the divisional controller, Midlands Division, B.E.A., MR. E. SALTHOUSE, chief draughtsman, electrical drawing office, Harland & Wolff, Ltd., MR. R. SMITH, head foreman electrician, Cammell Laird & Co., Ltd., MR. E. J. TRAPNELL, area secretary, Somerset and Gloucestershire, E.T.U., MR. W. E. WATSON, area works manager, S. Smith & Sons (England), Ltd., MR. T. S. WOOD, chief draughtsman, Electrical Department, John Brown & Co., Ltd., MR. J. F. BOOTH, managing director, Hepworth Iron Co., Ltd., and MR. A. G. BOURHILL, assistant power station superintendent, Electricity Department, Singapore City Council.

The award of the British Empire Medal (B.E.M.), has been made to MR. V. A. ALDOUS, lathe turner, English Electric Co., Ltd., MR. P. ALLEN, mains foreman, South Western Electricity Board, MR. F. ASKEM, electrician, Darwins, Ltd., MR. S. M. T. BEACH, foreman, Ferguson, Pailin, Ltd., MR. A. BLUNDY, foreman, Hydraulic Testing Department, Worthington Simpson, Ltd., MR. A. CARR, power house attendant, East Midlands Division, N.C.B., MR. W. T. FOSTER, shift electrician, London Electricity Board, MR. A. A. GLENNIE, foreman bricklayer, Battersea power station, London Division, B.E.A., MR. A. J. HARWOOD, turbine driver, Oxford power station, Southern Division, B.E.A., MR. P. LEWIS, shift substation attendant, Merseyside and North Wales Electricity Board, MR. J. S. MCARTHUR, foreman linesman, Birmingham Transmission Section, Midlands Division, B.E.A., MR. A. STRONGE, construction foreman, Electricity Board for Northern Ireland, MR. J. WALKER, installation inspector, Fife Sub-Area, South East Scotland Electricity Board, and MR. G. W. WILDMAN, boilerhouse foreman, Greenhill power station, North Western Division, B.E.A.

Electricity Board Appointments

THE following appointments and reappointments as part-time members of the various Area Electricity Boards are announced by the Ministry of Fuel and Power :—**London Electricity Board.**—Mrs. G. H. Dunbar, O.B.E. (London), and Mr. W. J. H. Wood, M.I.E.E., M.I.Mech.E. (Sevenoaks) (reappointments).

Merseyside & North Wales Electricity Board.—Mr. J. A. Duncan, B.Sc. (Woodchurch, Wirral), Mr. G. K. Paton, M.I.E.E. (Wrexham), and Sir Arthur Pickup (Hoylake) (reappointments).

North Eastern Electricity Board.—Ald. J. W. Mitchell, J.P. (South Shields) (reappointment).

Southern Electricity Board.—Ald. J. P. D. Lacey, O.B.E., J.P. (Portsmouth) (reappointment).

South Wales Electricity Board.—Mr. B. Curran (Cardiff), Principal R. James, Wh.Sch., D.I.C., M.I.Mech.E., A.R.C.S. (Treforest) (reappointments).

South East Scotland Electricity Board.—Mr. G. McLaren, C.B.E., J.P. (Stenhousemuir), and Sir Ernest Wedderburn, O.B.E., D.L., D.Sc., LL.D., D.K.S. (Edinburgh) (reappointments).

South West Scotland Electricity Board.—Mr. J. Millar, C.B.E., J.P. (Glasgow) (reappointment). Mr. R. Allan (Clydebank) and Commander G. H. Hughes-Onslow, D.S.O., R.N. (ret.) (Alton Albany, Barr) (new appointments).

Mr. J. B. Mavor, M.I.E.E., M.I.Mech.E. (Glasgow), a part-time member of the Board, retired on 31st December on completion of his term of office.

CORRESPONDENCE

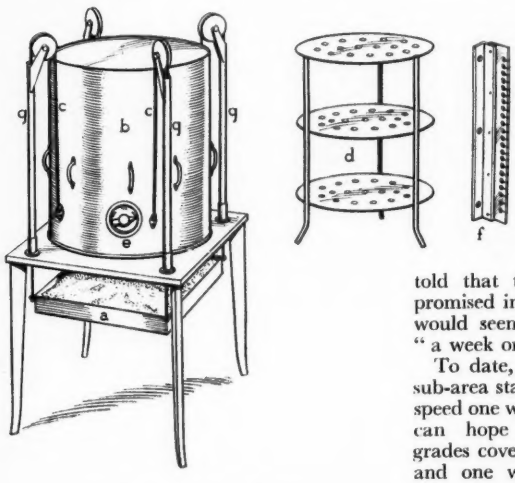
Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

An Early Electric Cooker

HAVING noted that in recent issues of the *Electrical Review* a certain amount of interest is being shown in the earlier types of electric fires, etc., you may consider of interest one of the earliest electric cookers, if not the first. The enclosed rough sketch shows the cooker designed by Mr. Napier Prentice in about 1905. (Mr. Prentice was then, I believe, chief engineer at Stowmarket.)

Only a few of these cookers were manufactured, as they did not find a market, probably owing to the then high cost of electricity. One ingenious point about the cooker was that when the cylindrical body was lifted there was practically no loss of heat. Further, it allowed an all-round inspection of the food cooking.

Sutton, Surrey. W. H. SHIPMAN.



Mr. Napier Prentice's Cooker

(*a*) Sand filled tray (as counterweight). (*b*) Oven body hanging on Bowden wires, the counterweight making easy the raising of the cylindrical body. (*c*) Bowden wires. (*d*) Cake-stand type interior. (*e*) Rotary three-heat switch. (*f*) Metal angle holding mica strip drilled to take nichrome heating wire; fastened vertically inside cylinder (about 20 strips needed to go all round); heating wire tapped to give ¼, ½ or full heat. (*g*) Tubular pillars holding pulleys. (*h*) Wooden table.

The "Fourth Leg"

THE statement on this subject in your issue of 19th December, which presumably emanates from B.E.A. sources, is naïve to say the least. True, there were conflicting interests on the employees' side but the agreement was signed on 1st August, 1951.

What has happened during the intervening 16 months? In December, 1951, the Authority tabled broad salary proposals which were so broad as to be incapable of interpretation. It is understood that the employees' side immediately asked the Authority for its organization "trees" showing the application of the suggested grades, but despite repeated requests these, so far as is known, have not yet been produced in detail.

Divisional and Central Authority proposals have been issued recently and we are told that the Area Board proposals are promised in a week or so. Incidentally, it would seem that these were promised in "a week or so" as far back as October.

To date, there has been no mention of sub-area staffs and at the present indicated speed one wonders when these lesser mortals can hope for settlement. Managerial grades cover a limited number of positions and one would have thought that consideration as a whole and not piecemeal was obvious, particularly as the functions of sub-areas are indivisible from those of Area Boards.

One must deduce a complete lack of sense of urgency on the part of the Authority. Until very recently there were no regular meetings of the two sides and

on the only occasion when a meeting date was settled in advance it is understood the Authority cancelled it because it was not ready. The whole story is a sad reflection on top level negotiation and one wonders how calls for patience by the Associations to their members would have been received if the negotiations had involved lower grades of employees.

The letter from Mr. Davis adds nothing to the picture except that perhaps he summarizes the complete lack of progress in succinct style and here I quote: "There remains the formulation of new and unified scales of salaries." Exactly, and it is now 1953!

"FOURTH LEG."

Freedom of Choice

I NOTE with satisfaction that you report on page 1400 of your issue of 26th December the opinion of a member of the North Eastern Gas Consultative Council that it would be a serious matter if there were not freedom of choice in fuels.

After the spate of anti-electric propaganda, in which it would appear to any observer that the use of electricity for domestic space and water heating should be made illegal, it is refreshing to note this observation although the reason for it is quite obviously due to the Gas Council's upset at losing business.

Your report goes on to state that some housewives wondered what the cost of their consumption would have been if it was gas instead of electricity. In this respect you could probably help the electricity supply industry by publicizing the portion of the Ridley Report dealing with this. I refer to page 32 Table VI and the first section of it. The weekly cost of a complete fuel service for a small house is shown as: All gas 26s, all electric 22s, and all coal 22s 6d.

V. J. SIMSOM (Ferranti, Ltd.).

Moston, Lancs.

Joint Consultation

THIS Society was very interested in Mr. W. Walsh's article on joint consultation (*Electrical Review*, 26th December, 1952). It is good to see among technical articles one which refers to the human factor in industry, and which recognizes its importance.

The Society has been advising on joint consultation for many years now, and has felt all along that there was a need for some simple manual to put into the hands of the elected representatives, so that they might understand both the scope and the techniques of the meetings which they attend.

"The Works Committee Members' Handbook" has now been published, and has met with a very satisfactory response both from management and trades unions. Readers of Mr. Walsh's article who would like to take the matter further are invited to inquire from the Society at Robert Hyde House, 48, Bryanston Square, London, W.1, about this booklet and about a study of joint consultation entitled "Works Councils and Committees" which has recently been issued by the Society in up-to-date form.

THOMAS FASSAM,
Publications and Press Relations Officer,
Industrial Welfare Society.

London, W.1.

Electric Clocks

RECENT letters praise battery-driven clocks, as compared with synchronous clocks when fed with "B.E.A." frequency, but are your correspondents correct when they say that they are "British made." I have seen many such clocks with this description on the dial, and that is as far as "British made" goes; the essential works were of French origin.

Mr. Mangue refers to his being in touch with the "makers." I am sure thousands of your readers will be pleased to have the makers' name. Will he please provide it?

Shalford, Surrey. R. E. BRISTOW.

"Switch On"

YOU may be interested in the following paragraph which appeared in a recent issue of the East Suffolk Federation of Women's Institutes' "Country Letter":

"*Use of Electricity*

"Economy is still necessary during peak hours. The time for which restraint is asked is shorter. The measure of economy required is less. The W.I. representative on the Eastern Electricity Consultative Council sends us this note—

"'Switch on, switch on, except for peaks your conscience can be free
But if the winter's very cold, then heed the B.B.C.'"

The injunction to "switch on" is indeed a welcome sign.

Wherstead, Ipswich. E. A. FOWLER,
Chief Commercial Officer,
Eastern Electricity Board.

VIEWS on the NEWS

By REFLECTOR

THE Southwark Trades Council is reported to have been puzzled by the local Electricity Saving Committee. When the Council nominated a representative to the Committee it was told that the "season of work" was now over and no meetings would be held during the winter. The chairman of the Council thought this was queer and a member suggested that the Committee should be asked what it did to justify its existence. Of course the arrangement is not really so queer; it is in the summer that plans must be made for winter economies. But the appearance in summer of reports of such a committee's activities are more likely to result, unnecessarily, in economies in that season than in the subsequent winter.

* * *

One method of ensuring electricity economy does not seem to have worked properly. At a school in Birmingham there were installed switches which could be operated only by a special key held by somebody specially charged with the job of switching on. It was forgotten, however, that the same key was needed for switching off and that it was unlikely that people leaving a room were going to search for the "switcher-off."

* * *

Starlings have become a nuisance in some districts and various methods of getting rid of them have been tried, some of which were recently mentioned in *The Times*. Birmingham seems to have been most active in this matter. There experiments have been made with electrified wires but the birds had sufficient sense to keep off. Then a beam of ultrasonic waves with an effective range of fifty yards was tried but the starlings dodged it and roosted comfortably elsewhere. They ignored ultraviolet rays which were tried "in the hope that the unusual appearance of one bird to another might cause fighting." So far, then, the starlings have the laugh.

* * *

Among the Western influences which are making themselves increasingly felt in the East is electricity—if such a universal agent can be regarded as "Western." The latest manifestation of this is reported from Singapore where the City Council is acquiring 500 special electric cooking devices for hiring to the local population. The usual way of cooking rice is in a *kwali*, a kind of bowl, which is heated by charcoal in a bucket shaped to take the bowl. The new device is also designed to take the *kwali* but the charcoal is replaced by radiant hotplates with simmering control. This seems to offer prospects of other forms of domestic electrical development in Eastern countries.

* * *

In the children's television programme (at which I often look) last Saturday the Birmingham Electric Club's annual children's party at the Grand Hotel, Birmingham, had a good place. Everything was done (and done very well) to give the youngsters a good time; there were a puppet show, a conjuror, Santa Claus, who arrived in a "jet plane," balloons and all the other trimmings. But the best entertainment for the adult viewers was the juvenile audience whose varied expressions were a delight.

* * *

Electricity meters in old people's dwellings at Kidsgrove (Staffs) are being fixed low down so that they can be reached without the aid of chairs or stepladders. I consider this to be a sensible practice whether the consumer is old or young.

New Lamp Column

Functionalism in Street Lighting

By D. G. SANDEMAN
B.Sc., A.M.I.E.E.*

NO state of mind is so stagnant as that which affirms that "only the instructed are capable of judging whether this or that is good." Good taste, good manners, or, in fact, anything good is surely to be assessed by all, and from every angle.

Consider for a moment the appalling snobbery of the exponents of the unreal branches of modern art. We are told that the man in the street, without instruction, is incapable of appraising the "worth"—one can hardly say "beauty"—of these productions. In architecture also we are tempted to think that Alice in Wonderland's "uglification" is being taught in our art schools.

Modern trends, however, are not all in reverse and the honesty of purpose which is sweeping aside convention has given us the idea of "functionalism." This is an expression which means making something for use, not for beauty. The best example of functionalism is the Forth Bridge, in which the engineer has expressed his purpose in the medium of steel. The result is judged by all to be good, even beautiful, for we see it repeatedly on a number of homely articles, such as paper weights, butter dishes, table cloths, etc.

The illustration, Fig. 1, is a photograph of scale models of a street lamp column designed to appear evenly illuminated throughout its whole length. The horizontal section is a triangle, with two sides bright and one dark. It is an advantage to illuminate the column because it then acts as a guide to traffic, delineating the road and providing a light background against which the traffic can be seen.

If a source of light of I candle power (Fig. 2, top) is situated at the point O, then the illumination at P is:

$$E = \frac{I \cos\phi}{R^2}$$

If this is constant, then:

$$E = \frac{IRd\theta}{\sqrt{(Rd\theta)^2 + (dR)^2 R^2}}$$

Fig. 1.—Scale models of street lighting column seen from rear. Construction is shown on right (cover plates removed)

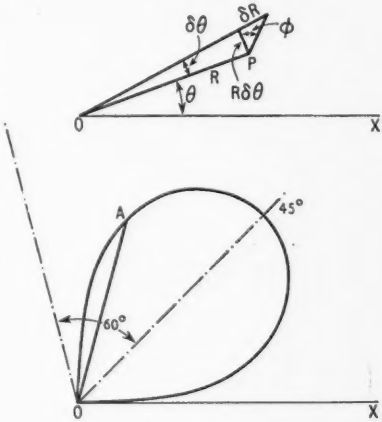


Fig. 2.—Shape of profile calculation from equation

* Head of Engineering Department, East Ham Technical College.

Fig. 3.—An impression of a street scene employing lamp columns of the type described

Thus the solution of this equation gives the shape of the profile:

$$R = \sqrt{\frac{I}{E} \sin 2\theta}$$

It is illustrated in Fig. 2 (bottom), but so far our problem has been considered in two dimensions only. If we rotate the profile about the $\theta = 45$ deg axis a pear-shaped solid surface is formed, affording constant illumination with the light source at the origin.

The lamp column design uses a slice of this surface on each side. To obtain, the complete construction, imagine the 45 deg axis rotated through 60 deg in the plane of the paper and a second pear-shaped solid formed on it in the new position. The two solid surfaces would intersect along a vertical plane shown in the diagram at OA. The column surfaces are formed by the angle at this intersection.

A strange thing is that the result is a very beautiful curved design from purely functional considerations.

The column must be set at the back of the footpath and it will help to illuminate pedestrian traffic as well as the road users. This feature is unique and novel. The bright surfaces can be used for names of streets, towns, or for "Safety First" and other publicity. At the moment it is not possible to obtain steel, but we shall keep the idea for better times.

Belfast Power Station Contract

AT a recent meeting of Belfast City Council the acceptance of a tender of £391,211 for water cooling, switch house and ancillary works at the new Victoria power station, by the Electricity Committee, came in for severe criticism. It was stated that from seven tenders received, the Committee had accepted the second lowest, which was £17,000 more than the lowest figure.

The town solicitor said that before accepting the tender the Electricity Committee had taken expert advice from its officers and consultants. Ordinarily, they would accept the lowest tender where everything was equal, but many things had to be taken into account.

In the course of the ensuing discussion, the fact was stressed that the essence of the contract was time, and that if the new station was not in commission by the date fixed, there would be load-shedding not only in Belfast, but in other parts of the province. Although the Electricity Committee recommended the acceptance of a tender which was not the lowest, in the long run it would be the better bargain.

The minutes of the Committee were passed by a majority vote.

Nuclear Power

Symposium at I.E.E.

A GREAT deal was done to ventilate some of the electrical engineering aspects of the nuclear energy sciences at the Institution of Electrical Engineers, London, yesterday (Thursday) when Sir John Cockcroft, C.B.E., M.A., M.Sc.Tech., Ph.D., F.R.S., M.I.E.E., delivered a lecture on "Nuclear Reactors and their Applications" and a number of papers on "Nuclear Reactor Instrumentation" were presented.

The individual papers were "The Control of a Thermal Neutron Reactor," by Mr. R. V. Moore, G.C., B.Sc. (Eng.), M.I.E.E., A.M.I.Mech.E.; "Automatic Control Characteristics of Thermal Neutron Reactors," by Mr. J. H. Bowen, B.Sc., A.M.I.E.E.; and "Neutron Detectors for Reactor Instrumentation," by Messrs. T. A. J. Jaques, H. A. Ballinger, A.M.I.E.E., and F. Wade, Associate I.E.E.

Sir John Cockcroft said that nuclear reactors could be divided into two main classes: thermal reactors in which the chain reaction was carried on by neutrons from fission which were slowed down by collision with a "moderator" of graphite or "heavy water" until they reached "thermal energies" at which they had a high probability of producing fission in the uranium 235 component; and fast reactors in which no moderator was used and the fission neutrons were slowed down as little as possible before further fissions were produced, and in which there was a core containing uranium with a high uranium 235 content.

Sir John showed a balance sheet for a graphite reactor, indicating that for each primary fuel atom of uranium 235 destroyed about 0·9 atoms of the secondary fuel plutonium were produced, together with radioactive fission-product atoms. Reactors thus tended to change from primary to secondary fuel and this change altered the neutron balance.

The technical problems of reactor design fell into the groups: metallurgical, physical, chemical and engineering, and the engineers had to deal with the problems of heat transfer to the coolant, heating of all components by radiation, control, safety and construction. Control of a thermal reactor by the insertion and withdrawal of control rods containing boron was made possible by the fact that about one per cent of the fission neutrons were emitted at times up to one minute after fission.

Fast reactors could be controlled by changing the proportion of neutrons which escape by altering the geometry of the reflector. Fast neutron fission produced about the same proportion of delayed neutrons, so that the time-constants of control were not effectively different.

Sir John dealt particularly with two typical examples of research reactor, the Harwell graphite-moderated reactor and the Chalk River reactor, leading up to his main theme, the applications of reactors for the production of power. He thought the first type of nuclear power station would be likely to use natural uranium fuel elements and that it could use either a graphite or a heavy water moderator.

The power reactor would be designed to have the longest possible "burning time" of the fuel corresponding to the maximum utilization of the uranium. He gave rough estimates of the cost of electric power produced by nuclear reactors for different prices of the uranium fuel elements and different burning times and some details about the first fast reactor operating in the U.S.A. and producing about 250 kW of electric power. Reactors using highly concentrated nuclear fuel plutonium or uranium 235 would be employed first to develop power reactors having a high efficiency of utilization of uranium by "breeding" more secondary fuel than the quantity of primary fuel destroyed.

THERMAL REACTOR CONTROL

Throughout his paper Mr. Moore developed the principles of the design of the control system of the thermal neutron reactor, and he stressed that the dominating

effect was the fission of the uranium 235 isotope by neutrons reduced to a state of thermal equilibrium by the slowing down action of the moderator, but the ability to control the chain reaction and enable the heat to be removed from the reactor and utilized as demanded by the operational requirements of the power plant was the main theme of the paper.

In a simple conception of reactivity and reactor states the author developed mathematically the formula: if $\delta K = 0$, i.e. $K = 1$, then $\frac{dn}{dt} = S$, where S is the number of neutrons added per unit volume per second by spontaneous fission, dn = the neutron density, dt = the time density, K = reproduction factor and δK = reactivity = K − 1, assuming that all neutrons are emitted at the instant of fission.

But he explained that in reality a small fraction of the neutrons emitted were delayed as they emanated during the decay of radioactive fission products, and he set up equations for six group conditions throughout the time emission.

Self-induced changes in reactivity were named as " built-in activity," which meant that when a reactor was operating its reactivity was altered and in the main decreased by a number of self-induced changes taking place within the reacting core; " fuel depletion " which was explained by the fact that as the nuclear reaction proceeded the primary fissionable nuclei became depleted, although in uranium fuels self replenishment occurred owing to a secondary reaction in which plutonium 239 was bred by neutron reaction from uranium 238; and " poisoning " due to the formation, after fission, of materials within the fuel elements which had a significant absorption cross section for thermal neutrons.

The importance of the poisoning effect was shown by convincing graphs, and a table which depicted the build-up of the poison isotope or decay product xenon 135 following shutting down.

A fourth self-induced change in reactivity was " temperature coefficient of uranium and graphite." The temperature at which a reactor operated had a marked effect on its reactivity because (*a*) the physical dimensions and density of uranium and graphite varied with temperature and (*b*) their neutron scattering and absorbing properties varied with thermal neutron energy.

In discussing the thermal characteristics of reactors the author suggested that, given a limiting value above which the temperature of the fuel elements must not rise, it might be possible to design the system so that sudden values of δK released under fault conditions were limited in magnitude, thus enabling the reactor to stabilize itself.

Finally, the author discussed at considerable length starting up and shutting down the reactor, using characteristic curves of the B.E.P.O. plant to illustrate this.

CONTROL CHARACTERISTICS

Mr. Bowen described the influence of the phenomenon of " delayed " neutrons on the problem of automatically controlling the power level of a thermal nuclear reactor and showed that the frequency-response characteristic of a reactor had been both worked out theoretically and confirmed experimentally.

The author defined the mean lifetime of a neutron " τ " as the average time between a fission of uranium 235 producing " prompt " neutrons (those which might be immediately released as the result of the fission of an atom) and the occurrence of a further fission brought about by one of these neutrons (the value is about one millisecond); and the reproduction factor " K " as the average number of neutrons produced in a prompt fission which, in turn, resulted in further fission. He advanced mathematically one-group and two-group theories relating to the output power of the reactor from the law $Po = Po\ (o)\ \epsilon^{ut}$ where " Po " is the output power of the reactor, Po (o) is the value of this power at any time after the initial transient has died out, " t " is the time measured from this instant and " u " is a function of the neutron multiplication constant or reproduction factor " K."

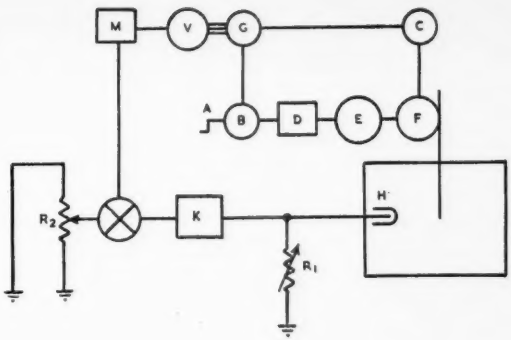
In practice the simple control system built on the one-group theory was seen to be capable of providing a well-damped response without the inclusion of any external stabilizing devices; while in a two-group theory account was taken of this single group of delayed neutrons as well as the " prompt " neutrons.

From these simpler theories the author developed a more accurate theory expressed by the equation:

$$\frac{Po^{(w)} = A/n\ (\omega)/\cos\ (\omega t - \phi)}{Pm}$$ where

Pm = mean value of the output power

Schematic diagram of control system of experiments made with graphite uranium thermal neutron reactor



A —Input controlling rod position
B —Input magslip element
C —Magslip indicating control-rod position
D —Amplifier
E —Amplidyne
F —Control-rod drive motor
G —Differential magslip
H —Ion chamber
K —Pen recorder including amplifier
V —Velodyne motor
M —Velodyne amplifier
R_2 —Ion chamber signal resistor
P_1 —Potentiometer

about which the periodic variation occurs, P_0' = instantaneous value as regards amplitude and phase of the component of Po having angular velocity ω, n (ω) = complex function involving the mean neutron lifetime and decay periods, in addition to the indicated argument (ω), and ϕ = any n (ω).

By reference to a layout diagram of the equipment used Mr. Bowen described the experiments carried out to test the validity of the analyses made. An attempt to inject an oscillating signal into the circuit at the point M and to measure the open loop power fluctuations was unsatisfactory. Experiments were therefore made on the closed loop system by applying the signal at the point R_2.

NEUTRON DETECTORS

Messrs. Jaques, Ballinger, and Wade showed that ionization chambers now existed which were capable of controlling a reactor over a flux range of 2×10^5, by using a boron 10 coating and hydrogen filling in a T.Q.T. chamber, and that the use of γ-ray compensated chambers should enable this range to be extended to 2×10^7.

A thermocouple with alternate junctions coated with, say, boron could be designed to be of relatively small dimensions, and it appeared to be ideal for flux scanning measurements. A neutron detector for use as an installed monitor need not necessarily be small, nor need it be capable of operation in the centre of the reactor where the flux density was the maximum.

Two types of neutron-sensitive thermopiles were described and illustrated—bead type and disc type—and common to both was an assembly of thermo-junctions with alternate junctions coated with boron, but instead of the small beads of natural boron at each junction of the bead type, the second type used small discs of two per cent boron steel as the active elements at each junction. In both types each pair of thermo-junctions in the thermopile were connected in series opposition for ambient temperature cancellation and in series assistance for neutron measurement.

Ionization chambers had the special advantage of short response times and for this reason they were used both as power level indicators and for safety circuit operation. The type T.P.A. chamber had already been described by Taylor and Sharpe and type T.Q.T. used a deposit of boron on one of the electrodes as the active material, instead of the boron being introduced into the chamber as boron trifluoride gas.

In table form were summarized the result of observations made of the ionization currents produced by the residual γ-ray activity in a nuclear reactor at various times after shutting down. For a chamber having a neutron γ-ray ratio of 70 the minimum neutron flux measurable 15 minutes after shut down was 3×10^6 neutrons/cm^2/seconds.

Proposed New Telephone Exchange

The Post Office is considering a proposal to provide a telephone exchange, to be named "Kipling," to relieve the existing exchanges in the Eltham, Bromley and Lee Green districts. The proposed exchange is not expected to be in operation before 1960.

Street Lighting in Plymouth

As part of the replanning of Plymouth, the South Western Electricity Board, on behalf of the City Council, has redesigned much of the street lighting system, using equipment supplied by the General Electric Co., Ltd. In the city centre and other shopping areas, fluorescent and mercury lighting are replacing tungsten, while mercury lighting has been installed along the new Crownhill by-pass from Plymouth to the Cornwall Ferries.

New George Street and Mutley Plain are among the streets in which new fluorescent lighting has been installed. Down the centre of New George Street the first twelve Z8381 "Three-Eighty" lanterns each housing three "Osram" 5ft 80 W tubes are arranged in pairs on six specially designed concrete columns. The designers, by allowing a slight dihedral on the arms and incorporating a special finial, have given a cohesion to each column which it would otherwise lack. Nine more double columns have been erected down the centre of Mutley Plain, spaced at 100ft intervals, and seven single columns of similar design have been mounted at the sides.

For one and a half miles along the centre reservation of the Crownhill by-pass 82 G.E.C. "Blown Glass" cut-off lanterns with "Osram" 400 W mercury lamps illuminate the dual carriageways, each of which is 24ft wide. The concrete columns are spaced at 90ft. The saving in the number of columns by using this system enabled excellent lighting to be obtained at minimum cost.

Along 1¼ miles of the A.38 road leading out of Plymouth to Exeter, 51 "Dioptrion" lanterns housing 250 W mercury lamps are mounted by brackets on concrete columns spaced at 120ft. Although the carriageway is in places 50ft wide, the resultant illumination of the whole road is excellent, brackets with a 6ft overhang being used on the wide sections. Further additions are being made to this road by the erection of 22 "Dioptrion" lanterns and columns.

In Wolseley Road, from the Milehouse Omnibus depot to Camelshead Corner, 67 "Dioptrion" lanterns and 12 "Blown Glass" cut-off lanterns accommodating 400 W mercury lamps mounted on concrete columns are to be erected so that the lighting will harmonize with that of the Crownhill by-pass.

Dual carriageway of the Crownhill by-pass from Plymouth to the Cornwall Ferries lit by 400 W mercury lamps in "Blown Glass" cut-off lanterns

Sound Broadcasting

At the Institution of Electrical Engineers in London last week Dr. K. R. Sturley (B.B.C.) gave a lecture on the technical aspects of sound broadcasting before a large audience of obviously keenly interested children. The lecture was repeated on the following afternoon.

Dr. Sturley began by explaining that since the broadcast apparatus was an essential link between the artist and listener, it must not only pass technical tests but the result must also sound right; at the same time cost must not be forgotten. With the aid of many demonstrations, Dr. Sturley gave what was undoubtedly one of the finest in this series of Christmas lectures and explained how the engineer achieved a satisfactory compromise and what would happen if he failed.

He surveyed the broadcast chain from artist to aerial after which the characteristics of the ear were illustrated. The studio and the treatment of its surfaces to give the right acoustic "atmosphere" were then considered, recordings and a ripple tank being used to show the character of good and bad studios. Microphones from Writtle days to the present time were on view and recorded and "live" illustrations of their use and misuse given. The various types of distortion which could occur in the amplifying equipment were demonstrated.

The "electrical sound" received from the microphone could not be broadcast as it was, and apparatus had been constructed to show the method of attaching it to the radio carrier which took it to the listener's receiver. A miniature transmitter was employed to show how the radio energy of carrier and programme was projected into space from various types of aerial.

Commerce and Industry

Appliances Freed from Control

Italian Television Plans

CONTROLS on the manufacture and supply of electrical appliances were ended on 31st December by the Minister of Supply. The Orders revoked are the Machinery, Plant and Appliances Orders, 1945 and 1948, and the Electrical Appliances (Control of Manufacture and Supply) Orders, 1942 and 1943. The appliances affected are:—

Machinery, Plant and Appliances Orders.—Machinery and plant (including parts) for laundering or dry-cleaning or dyeing made-up goods; refrigerating. Machinery, plant and appliances (including parts) being:—Carding and card clothing and all material of wire and pin construction for carding surfaces; machines (not being house service meters) operated by coin-freed devices ("slot machines"); apparatus for cinematograph projection employing film 16 mm or more in width (including sound-producing equipment for use therewith); and lawn mowers.

Electrical Appliances Orders.—Hand hair-waving, hair-drying and hand-drying machines; cooking, pressing, drying, heating and cleaning apparatus of a kind suitable for domestic or personal use, including water heaters, vacuum cleaners, motor car heaters (not being heaters designed solely for heating motor car engines or radiators) and heating pads and blankets; curling irons, waving irons, dry shavers, smoothing irons, lighters, lighter elements, hair clippers, health exercisers, drink mixers, and fans with motors not exceeding one-tenth horsepower.

The revoked Orders provided that none of the scheduled goods should be manufactured except under licence granted by the Board of Trade or Ministry of Supply.

The Human Factor

Since the war there has been a great increase in attention to the human factor in British industry. A number of investigations have been carried out inspired by the wartime Human Factors Panel of the Council of Industrial Productivity. The results and conclusions of these investigations have recently been published. To provide an opportunity for directors and senior management representatives of Midland industries to obtain an appreciation of the results of this work, the Department of Industrial Administration of the College of Technology, Birmingham, has planned a series of lecture-discussions on "Recent Researches into the Human Factor," which will take place on five consecutive Thursdays commencing on 12th February.

The opening session will be addressed by Sir Charles Renold, J.P., chairman, Renold & Coventry Chain Co., Ltd., and founder-chairman of the Council of the British Institute of Management; he will discuss "The Aim of Joint Consultation." Mr. J. J. Gracie, C.B.E., a director of the General Electric Co., Ltd., will preside at the opening session.

Other contributors to the series of discussions will be Mrs. Winifred Raphael, B.Sc., Dr. W. H. Scott, Dr. Elliott Jaques, and Mr. John Munro Fraser, M.A.

First Irish Floodlit Football Match

The first floodlit football match played in Ireland took place at Grosvenor Park, Belfast, on 30th December, when Distillery A.F.C. played Burnley. The installation was carried out by W. Coates & Son, Ltd., Belfast, in conjunction with Eirco Wholesale, Ltd., and consisted of forty-seven Philips "Westgate" wide beam floodlights with 1,000 W g.l.s. lamps. On each side of the pitch seven poles carried three floodlights each. The arrangement was triangular, and the height to the uppermost floodlight was 38ft. The remaining five floodlights were used on the exits and paths to the enclosure.

Television Equipment for Italy

A co-ordinated group of orders for British equipment, amounting to £300,000, when completed will give Italy a permanent television network on a national scale. The orders, placed with Marconi's Wireless Telegraph Co., Ltd., through its Italian company, are for studios at Rome and Milan, medium-power transmitters at Rome and Pisa, and outside broadcasting units at Rome. The new equipment is designed to expand the existing experimental stations of the official Italian broadcasting corporation, Radio Audizione Italiana (R.A.I.), into a full-scale network. The main transmitter will be at Rome, with a satellite at Pisa. Each will have a 7½ kW vision (174–216 Mc/s) and a 2½ kW sound transmitter. Large studios now being constructed, two at Rome and one at Milan, will be completely equipped each with four Marconi "Image Orthicon" cameras, a zoom lens attachment for one camera, and full switching and mixing controls. The R.A.I. has decided to adopt the B.B.C. studio plan with separate rooms for producer and technical control. Rome is also to have the equipment to fit two vehicles as outside broadcasting units,

and Rome and Milan will each have microwave links for sending back signals to the studio from outside broadcasts.

The whole system will operate on a 625-line standard, 50 c/s. R.A.I. are planning installation of a complete network of T.V. stations covering the whole of Italy. When this is completed transmitters will be operating in nine of the main population areas in Northern Italy. There will be a two-way video link between Rome and Milan.

Production in America

There is no one reason why the American worker produces more than the British. His higher productivity is due to a number of small factors. This is the main conclusion of a report on production and industrial engineering in the United States and Canada published for the Department of Scientific and Industrial Research by H.M. Stationery Office, price 1s (1s 1½d by post). The report is based on experience of a variety of firms, including car manufacturers, machine tool plants, textile machinery makers, mass producers of light electrical equipment, aircraft factories and so on. It indicates that in American factories mechanical aids are used much more than they are here and more attention is paid to ease of manufacture at the design stage. The attitude of management and workers is also dealt with in the report which has been written by Mr. T. G. Elliott, who was mechanical engineering liaison officer in the United States from 1949 to 1951.

Lubricating Oil Engines

Shell-Mex and B.P., Ltd., have issued a book entitled "The Lubrication of Oil Engines," which surveys modern practice and includes notes on the causes and remedies of operating difficulties and on selection of the lubricating oil.

Increased Risk with A.C.

The recent change-over from d.c. to a.c. in Stirling has brought increased danger, explained the district Inspector of Factories at Stirling Sheriff Court recently. William Somers, joiners, 81, Port Street, Stirling, pleaded guilty to having on 24th October contravened Regulation 13 of the Electricity (Factories Acts) Regulations by failing to earth effectively the metalwork of a heavy drilling machine, using a.c. Miss Brand, H.M. Inspector of Factories, referring to the change-over from d.c. to a.c., said that many occupiers of premises did not appreciate the greater danger involved in the use of a.c. The case had been brought to draw the attention of the public to this matter. For the firm it was stated that the drill had not been in use since the war and was taken out while one of the directors was away. The electrical wiring had now been altered throughout the factory and three-pin plugs had been installed to ensure that the regulations were complied with. A fine of £3 was imposed.

Coal Production in 1952

Statistics have been issued by the Ministry of Fuel and Power giving the production of coal in Great Britain during 1952. These show that the saleable output of deep-mined coal for the year totalled 212,830,700 tons, as compared with 211,270,700 tons for 1951. The output of opencast coal was 12,108,500 tons (against 10,985,800 tons for 1951).

X-ray Crystallography Lectures

Commencing on 15th January a series of ten lectures will be given at the Sir John Cass College, London, by Mr. E. G. Steward, B.Sc., A.Inst.P., of the X-ray section of the G.E.C. Research Laboratories, Wembley. These lectures, dealing with X-ray Crystallography, will be given on Thursdays.

Transformer for 275 kV Grid

One of the largest transformers ever to be built in this country has just been completed at the English Electric Co.'s Works at Stafford. Weighing some 163 tons in its completed operating condition, it left Stafford by road on 23rd December for delivery to the British Electricity Authority at West Melton, West Riding, where it is to be installed in the first section of the 275 kV overhead transmission line, which lies between the new power station at Newark and a point near Sheffield. Before leaving the works one of the tests—the impulse test—that was applied to this transformer, was at the level of about 1¼ million volts, said to be the highest voltage test ever applied to a power transformer in this country. Transporting the transformer presented special problems. It

English Electric transformer en route for West Melton, Yorkshire

could not travel at more than five miles an hour, and a mobile patrol was provided to clear the road ahead. After covering as great a distance as possible, the unit was parked during the Christmas holiday, before completing its journey.

Managerial Grades

Writing under this heading in the January issue of the official journal of the National and Local Government Officers' Association, Mr. L. G. Moser says:—

> "Representatives of the three Associations have discussed with representatives of the Central Authority and Area Boards questions which have arisen about the way in which some Boards have applied the 'informal agreement' to grant interim cost-of-living increases. In one area, the Board has had 'second thoughts,' and the position is to be substantially improved; in others, further information is to be supplied and some cases will be reviewed. There is reason to hope that there will soon be comparatively few officers with a grievance and their cases will then be taken up with the Boards concerned in the usual way. The Associations are—at the time I am writing—still awaiting the Boards' members' further proposals on salary scales. These were expected before Christmas—in time to enable both sides to include a speedy settlement of this overdue agreement as number one of their New Year resolutions."

A further letter on the subject appears in the "Correspondence" section of this issue.

Nickel Production in 1952

Dr. John F. Thompson, chairman of the International Nickel Co. of Canada, Ltd., has estimated that the free world output of nickel approximated 315 million lb in 1952, compared with 295 million lb in 1951, of which Canadian production accounted for 280 million lb, or about 90 per cent of the total. The free world production of nickel is believed to be over five times that of the rest of the world.

Sales Conference

Representatives, agents and sales staff of George Kent, Ltd., met at Luton for a one-day sales conference on 23rd December. At two separate sessions, the conference was addressed by members of the Luton staff and by Kent technical field representatives, and a talk on sales policy was given by Mr. R. G. Kent, sales director.

Methyl Bromide Fire Extinction

At a recent demonstration of fire fighting appliances at Feltham, Middlesex, by the National Fire Protection Co., Ltd., it was shown that methyl bromide was as effective in operation as carbon dioxide for the protection of electrical apparatus. Automatic equipment is recommended by the makers for use in substations and similar situations and at the demonstration a transformer fire was successfully

Demonstration of methyl bromide automatic fire-extinguishing apparatus

extinguished in approximately 10 seconds. This was done by the breaking of a combined gun-cotton and fusible link, culminating in the ejection of the liquid methyl bromide, which evaporated over the apparatus in a very short time.

Liquid methyl bromide is stored in cylinders under a maximum pressure of 100 lb/sq in and 2 per cent of C.A.P. (tear gas) is often added to the liquid to guarantee that any leakage (which is unlikely) is rapidly detected.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £166 0s 0d
COPPER, H.C. Electro	ton £285 0s 0d
Fire Refined 99·70 per cent ..	ton £282 10s 0d
Fire Refined 99·50 per cent ..	ton £274 0s 0d
COPPER Tubes	lb 2s 8⅝d
Sheet	ton £340 0s 0d
H.C. wire and strip	ton £335 0s 0d
LEAD, English	ton £103 10s 0d
Foreign	ton £102 0s 0d
MERCURY..	flask £70 10s 0d
TIN	ton £949 0s 0d
ZINC, G.O.B. Foreign	ton £90 0s 0d
Electrolytic	ton £94 0s 0d
BRASS Tubes	lb 2s 2⅝d
Sheet	ton £273 0s 0d
Wire	lb 2s 8¼d
PHOSPHOR BRONZE	
Wire	lb 4s 1¾d
RUBBER, No. 1 R.S.S. spot ..	lb 26d 26¼d

Summer School of Welding

The third Summer School of Welding organized by the British Welding Research Association will be held at Ashorne Hill, near Leamington Spa, Warwicks., from 27th April to 2nd May. This year the general theme of the School is welding fabrication and production and the various aspects will be covered in logical sequence during the course. Those

wishing to attend the School, or send representatives from their organizations, should communicate with the Secretary, B.W.R.A. Summer School of Welding, British Welding Research Association, 29, Park Crescent, London, W.1.

Tin Plate Workers' Scholarships

The Worshipful Company of Tin Plate Workers has decided to grant in 1953 ten travelling scholarships, each to the value of £50, on the same conditions as in previous years.

Australian Locos for Pakistan

The Canberra correspondent of the *Financial Times* reports that Mr. Casey, the Minister of External Affairs, says that Pakistan has accepted Australia's offer to supply nine main-line diesel electric locomotives under the Colombo Plan as part of a bigger programme of assistance to Pakistan railways from other countries. The locomotives will be made by the Clyde Engineering Co., of Sydney.

Revised Purchase Tax Notice

Notice No. 78 ("Goods Chargeable with Purchase Tax"), issued by the Commissioners of Customs and Excise, King's Beam House, Mark Lane, E.C.3, has been revised and copies of the new edition are being sent to traders registered for purchase tax purposes.

Change of Name

Transformers & Welders, Ltd., Watford, Herts., has changed its name to Transformers (Watford), Ltd. The change is due to the decision of the company to concentrate its activities on distribution and power transformers, together with furnace and special types of transformers. The company is a subsidiary of the London Brick Co., Ltd.

B.E.A.M.A. Annual Dinner

It is proposed to hold the 1953 annual dinner of the British Electrical and Allied Manufacturers' Association at Grosvenor House, London, W.1, on 18th November.

Trade Announcements

The Manchester Branch of **Drake & Gorham (Contractors), Ltd.**, has been transferred to 21, Newton Street, Manchester, 1

As from 12th January the head office of **Parnall (Yate), Ltd.**, will be at 255, North Circular Road, London, N.W.10 (telephone: Willesden 0076; telegrams: "Gascot, Phone, London;" cables: "Gascot, London").

Mr. H. H. Harper has been appointed area sales representative of **Evershed & Vignoles, Ltd.**, for South Wales and South West England. He succeeds Mr. S. B. Haslam who has been the company's agent in South Wales for many years.

The offices of the **T.B.T. Electric Co., Ltd.**, are now at Dashwood House, 69, Old Broad Street, London, E.C.2 (telephone: London Wall 3141/2).

The administration and sales organization of **British Moulded Plastics, Ltd.**, has been transferred to Avenue Works, Walthamstow Avenue, London, E.4.

Opperman Gears, Ltd., Newbury, has appointed Saunders & Purves, Ltd., 12, St. Mary's Place, Newcastle-on-Tyne, 1, as its sole agents for the counties of Northumberland, Durham, Westmorland, Cumberland and the North-Eastern corner of Yorkshire, and Andrew McNair & Co., 261, West George Street, Glasgow, C.2, as its sole agents for the whole of Scotland.

Catalogues and Lists

Ekco-Ensign Electric, Ltd., 45, Essex Street, London, W.C.2.—Revised price list of fluorescent lighting fittings, equipment and lamps.

E. K. Cole, Ltd. (Heating Division), 5, Vigo Street, London, W.1.—Two-colour folder together with a smaller priced leaflet illustrating the range of "Thermovent" and "Thermotube" electric space heaters.

Berry Wiggins & Co., Ltd., Field House, Breams Buildings, Fetter Lane, London, E.C.4.—28-page pocket booklet dealing with the use of "Kingsnorth" electrical filling compounds, including a temperature conversion table.

Heatovent Electric, Ltd., Abbey House, Baker Street, London, N.W.1.—24-page illustrated catalogue covering the range of "Tuvec" electric heaters, and installation hints, together with price list.

Tool Treatments (Chemicals), Ltd., Colliery Road, Birmingham Road, West Bromwich.—Descriptive leaflet on a new process plant and solution dealing with water removal and anti-rust treatment.

Precision Components (Barnet), Ltd., 13, Byng Road, Barnet.—Illustrated price folder on "Kabi" connector blocks and strips and a leaflet dealing with "Kabi" bench assembly and storage trays.

Ranco, Ltd., Industrial Estate, Newhouse, Motherwell, Lanarkshire.—Two illustrated folders dealing with the new "Ranco" refrigeration controls and thermostats

Multicore Solders, Ltd., Multicore Works, Hemel Hempstead, Herts.—Brochure entitled "Considerations of Soldering Technique in Radio and Television Assembly" (M 33).

New Day Electrical Accessories, Ltd., 136-8, Mary Street, Birmingham, 12.—Illustrated priced catalogue of switches, plugs, sockets, etc.

Misrepresentation

The Legal Aspect

By F. E. SUGDEN

WHEN an agent visits an electrical contractor for the purpose of selling electrical goods he may guarantee the soundness of those goods for a specific purpose. But, unknown to his principal, he may be guaranteeing something which he technically has no authority to do, although he may do it in all innocence. What is the legal position?

As I have explained in the past, where a case is cited in which the legal principles are the same, though the trade is different, the Court will definitely adopt them. Hence my reason for quoting the following case which went to the Appeal Court.

House Purchase Action

Briefly, the facts were these. In the course of negotiations by the plaintiff for the purchase of a bungalow belonging to the defendant, the agents of the defendant made certain statements as to the value of the property. Owing to the defective condition of the bungalow the statements were untrue, but the agents were not aware of the existence of any defects and so made the statements innocently, believing them to be true. The defendant, who was aware of the defective structural conditions, had not authorized his agents to make the statements, nor had he deliberately kept them in ignorance with the dishonest intention that they should mislead prospective purchasers, and he did not know that the statements were being made. Relying on the agents' representation, the plaintiffs bought the property. On discovering its defective condition, they sued the defendant and his agents for damages for fraudulent misrepresentation.

The Court held that in the absence of actual fraud or dishonesty on the part of a principal, knowledge by him of facts which were contrary to a statement made innocently by his agent did not render the principal guilty of fraudulent misrepresentation and, therefore, the action failed.

Naturally the electrical contractor will ask " What is the effect of this judgment on me and how can I safeguard against it? "

If an agent visits a contractor and gives a glowing account of certain of his goods, which the contractor either uses himself or re-sells to his customers, the agent himself may believe his statements to be true. If the goods concerned are a new line, which might or might not be popular with customers, then it is advisable for the contractor to get some documentary evidence from the agent's principal that the goods are all that they are claimed to be, namely, with certain electrical advantage as outlined.

Of course, if there are certain hidden defects in the equipment, the retailer can make a claim against the principal for loss, both as regards refund of the money paid for the goods and reimbursement of the amount refunded to customers. This is important because if a customer brings goods back as being defective and he has a reasonable case he would succeed in a court of law.

On the other hand, if the electrical contractor, in turn, tries to reimburse himself from the wholesaler and the wholesaler says that there was no guarantee attached to the goods and they were sold to him as they were, then unfortunately the contractor would lose his money.

Wilful or Innocent?

The main principle is whether the misrepresentation is fraudulent or not, because primarily the law is that if there has been innocent misrepresentation, the person misled or deceived is entitled to rescission of the contract.

But if there has been fraudulent misrepresentation, that is, it has been done deliberately without any regard for truth or accuracy, then the person deceived would be entitled to claim, first of all rescission of the contract and a refund of

the money already paid under the contract. But in addition, he would be entitled to damages which might include the actual loss of profit which he has sustained through this wilful misrepresentation.

Where a claim is brought by an electrical contractor against a manufacturer or wholesaler there may be two parts to the action. In the first place the contractor may have had to pay out damages for injury which the customer has suffered by reason of the misrepresentation. For instance, through faulty insulation the child of the customer may have received a shock and injury. Then if an action is brought against the contractor he can join the manufacturer as a third party which means that whatever the customer is awarded by way of damages from the contractor can be recovered from the manufacturer. In addition the contractor could claim for loss of profits suffered by him through the wilful misrepresentation of the manufacturer or wholesaler.

Electricity in Mexico

Present Development Mainly in Federal District

From a Correspondent

CONSUMPTION of electricity is one of the best indices of the rate of economic development. A study of electrical energy generation in Mexico reveals the vast forward strides achieved, especially in the last six years. Since 1945 the expansion of output has been maintained at an average rate of 15 per cent.

While Mexican electrification is only in its infancy in relation to the United States and the principal European nations, in Latin America it is already disputing second place with Argentina. According to official figures released by the Comisión Federal de Electricidad, capacity had reached 1,400,373 kW at the end of 1951, about half of the plant being hydro-electric and 36 per cent steam. At the close of the year under review Mexico had 1,828 generating plants which produced a total of 4,908·3 million kWh.

Mexican industry consumes 52·8 per cent of national production; residential service 14 per cent; commercial, including electric signs, 10·4; public lighting 8·4; agriculture 6·4; and other services 8 per cent. Consumption *per capita* rose from 170 kWh in 1948 to 790 kWh in 1951.

The speed of electrification in the near future will probably be greatly accelerated. While the Federal Bureau of Electricity has not as yet published its plan of progress there is every evidence that heavy investments will be made, especially in rural electrification, during the next six years under the regime of President Adolfo Ruiz Cortines.

The need for the extension of electricity supply in Mexico is shown by figures released by the Mexican Light and Power Company indicating that in the Federal District (Mexico City and environs) and in the surrounding area, inhabited by 16 per cent of the total population, about half of the country's total electricity production is consumed. Fully 75 per cent of the population, or about 20 million people, are still without an electricity supply. The Mexican Light and Power Company estimates that by 1960 the zone it serves will require 3,421 million kWh compared with the 1948 figure of 1,768 million kWh.

The Federal Electrical Commission plans to unify electricity production and distribution and in furtherance of this policy the Chamber of Deputies has approved the issue of federal bonds amounting to 120 million pesos for acquiring private electric utilities. Companies to be acquired when the bond issue is floated include the New Electric Company of Chapala, S.A.; Morelia Electric Company; Hydroelectric Company of Manzanillo; Western Hydroelectric Company; and the Guzman Electric Company.

MANUFACTURING PROGRESS, 1952

C. A. Parsons & Co., Ltd.

IN the turbo-alternator field C. A. Parsons & Co., Ltd., received orders during 1952 for sets of from 5 MW to 60 MW capacity for power stations in this country, Canada, Australia, South Africa and Venezuela. The 60 MW sets include those for the new stations at Stella North and South, Dalmarnock and Tilbury. All the alternators will be hydrogen cooled. Further 60 MW sets with air cooled alternators have been ordered for the new power station at Taaibos (South Africa).

Among the smaller turbo-alternators ordered, one is a 6 MW set for an ironworks in this country, and the turbine will be designed for passing out steam after partial expansion. Another is a 6·6 MW set with a back pressure turbine for a pulp and paper mill in Newfoundland.

A large number of turbo-alternators with a total capacity of over a thousand MW were completed on site or put into commercial operation. These include the second and third 100 MW sets in the Richard L. Hearn generating station, Canada, and 60 MW sets at North Tees, Skelton Grange, Keadby and Littlebrook in this country.

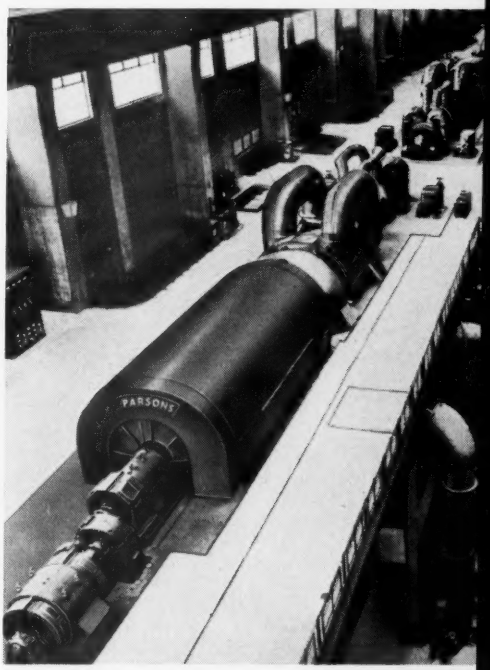
Work has proceeded on the erection of the 15 MW gas turbo-alternator set at Dunston power station, and on the 10 MW set for the National Gas Turbine Establishment at Farnborough. The construction of 2,500 kW and 2,000 kW sets for Singapore was in hand. As a result of the successful tests undertaken during the year on the burning of pulverized coal in a 500 h.p. experimental gas turbine plant, the Ministry of Fuel and Power, after consultations with British Railways, has ordered an open-cycle external-combustion coal-burning gas turbine locomotive. Parsons are constructing the 1,800 h.p. turbine and the North British Locomotive Co., Ltd., is building the locomotive.

An outstanding development in connection with transformers was the receipt of an order for the largest double-wound transformer ever to be made by the company. It is for a 120 MVA step-up (132 kV) generator transformer for operation with the 100 MW turbo-alternator which is under construction for the Ferrybridge power station.

The British Electricity Authority ordered from the company a further three 120 MVA 275/132 kV auto-transformers for interconnection of the new 275 kV and the existing 132 kV grids. On-load tap-change equipment is to be provided to give ± 15 per cent variation in 18 steps on the 132 kV windings.

Orders were also received for transformers for many other parts of the world, including Australia, India and Pakistan, South Africa, Trinidad and Venezuela.

The third 60 MW turbo-alternator was completed on site at Skelton Grange power station



The expansion of the oil industry in Venezuela has resulted in orders for two 18·75 MVA generator transformers and four 25 MVA 66/33 kV on-load tap-changing transmission transformers.

A number of generator and large power transformers were put into service, including the second 75 MVA equipment at the Keadby power station for direct connection to the 132 kV grid.

In the optical field work proceeded on the 74 in mirror for the Mount Stromlo telescope, and the surface of the parabolic was ground to within one wavelength of the figure required. An unusual achievement was the production of several large Schmidt projection corrector plates for television projectors for use in cinemas. These 23in diameter plates are polished to a specially computed and highly aspherical curved shape involving removal of glass to a depth of 0·07in at the lowest point.

Regarding infra-red instruments, 19 spectrometers were completed, including one each for France, Holland, Italy, India and Australia, and two for Government "super-priority" orders at home. Spectrometer performance has been improved appreciably, and double-beam production is getting under way satisfactorily.

Considerable interest was shown in the relay and alarm units developed for use in conjunction with gas analysers, and three special explosion-proof gas analysers were supplied to the Anglo-Iranian Oil Co., Ltd., for use in oil refineries in this country.

English Electric Co., Ltd.

AS is the case with most manufacturers of a wide range of plant and equipment, the activities of this company can be very broadly classified as supply and utilization with an inevitable degree of overlapping. First in the supply section there comes steam turbo-alternator plant, and once again provision for the requirements of the British Electricity Authority takes a high place; indeed the company commissioned for the B.E.A. a total of 275 MW of new steam turbo-alternator plant, including the third and fourth 50 MW turbo-alternator sets, with hydrogen cooled alternators, for the Bromborough power station. The steam conditions are 900 lb/sq in and 900 deg F. Work on the 1,500 lb/sq in 1,050 deg F, 100 MW set for Willington is progressing, and among the B.E.A. allocations were a second 100 MW set for Willington and a fourth 60 MW set for Wakefield.

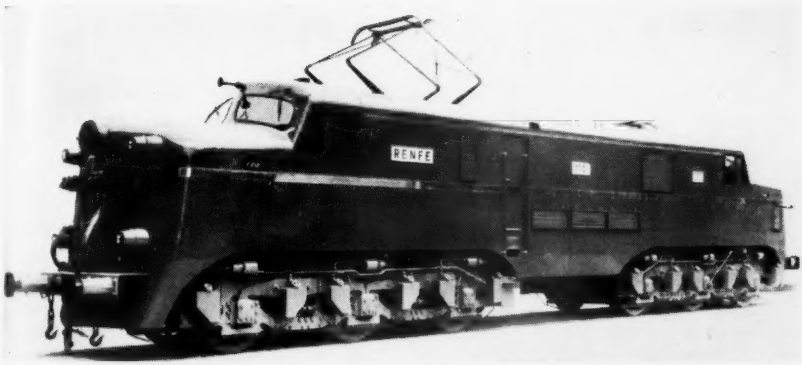
For private generation at home an order was received for a 15 MW back pressure set for the Bowater Paper Corporation, Ltd. This set will operate with steam at 1,500 lb/sq in and 900 deg F, exhausting against a pressure of 370 lb per sq in.

In the export field the second 60/66 MW set for the Windsor power station, Ontario, was commissioned. Three turbines of the ten sets for the Vierfontein, South Africa, power station were dispatched and the first set will be commissioned early this year. Orders received for abroad include those for a fourth 30 MW set for Pretoria "B" and a 10 MW set for the Shabani power station in Southern Rhodesia.

As regards hydro-electric plant, the third 22 MW set at Fasnakyle (North of Scotland) was commissioned. In Spain the third 40 MW set at Cofrentes was completed, and in Portugal the joint contracts placed with the English Electric Export & Trading Co., and the Metropolitan-Vickers Electrical Export Co., were nearly completed by the commissioning of the third units at Castelo do Bode and Vila Nova.

Early in the year the Kolhapur power station in India went into operation with two 1·5 MW sets with Kaplan type turbines. Late in 1951, too late for inclusion last year, a large contract was negotiated with the Tasmanian Hydro-electric Commission for equipment for two new power stations—Wayatinah with three 46 MVA turbo-alternator sets and Lake Echo with one 35 MVA set.

Notable orders in the diesel engine generator field included three 8-cylinder transportable engine alternator sets for the Metropolitan Water Board, two 6-cylinder alternator sets for Edmund Nuttall & Sons to whom the company supplied engines for the Claerwen Dam installation opened by the Queen last October, and two 6-cylinder engines for the Gloucester main drainage scheme. Export activities included work on five 8-cylinder engine-alternator sets for a jute mill in India.



One of the 3,600 h.p. 3,000 V d.c. locomotives for the Spanish National Railways

Transformer business again flourished and typical repeat orders received from the B.E.A. and Area Boards were:—five 72 MVA and five 60 MVA 132 kV transformers; and two 37·5 MVA and four 15 MVA 33 kV equipments. The first 275 kV transformer for service in this country was completed.

Great activity in the export market is indicated by the following selected contracts: South Africa—two 40 MVA and two 36 MVA 132 kV transformers; Southern Rhodesia—eight 10 MVA 88kV transformers; Uganda—two 15 MVA 132 kV units; New South Wales—two 30 MVA 132 kV units. Similar work for Tasmania and India is in hand.

There was a high demand for switchgear, and various 132 kV air-blast gear was ordered by the B.E.A. Orders from abroad included circuit breakers for Australia and Spain, while an order for a 220 kV substation with six circuit breakers for a hydro-electric scheme abroad was received. There were calls for a large number of outdoor circuit breakers ranging from 11 kV to 88 kV for service at home and in Australia, South Africa and Greece, with a preponderance of orders for 33 kV breakers for installation in Great Britain.

Indoor metalclad gear, particularly of the 11 kV 350 MVA rating, was in great demand. A highlight of the year was the successful short-circuit test carried out on the type O.B.33L 3·3 kV air circuit breaker at the Nelson Research Laboratories.

The fusegear works continued to manufacture large quantities of high rupturing capacity equipment for use in power stations and in steelworks and other industrial plants. Activity in the instrument world increased considerably, and this included development to widen the available range of polyphase meters, indicating instruments and protective relays.

In the utilization category the Metal Industries Division probably topped the list and plants commissioned include the drives for three rolling mills for non-ferrous metals and three for mills for ferrous metals. At home hot mill drives commissioned include those for a continuous copper rod mill and a semi-continuous aluminium mill. The former includes four 210 h.p. motors and an 850 kW grid controlled rectifier. Cold rolling mill drives include one of 1,500 h.p. for a 1,000 ft/min 50 in wide aluminium strip mill with a 300 h.p. motor driven coiler, and a 600 h.p. main drive and two 430 h.p. coiler drives for a Sendzimitz mill for stainless steels.

Auxiliary drives of particular interest include those on a slabbing mill on the North East Coast which now has a pair of 75 h.p. screw down motors which will give 150 h.p. each at twice the rated voltage and speed. With the necessary motor generator set and control exciters, the whole equipment is the first in service of many really up-to-date hot mill Ward Leonard auxiliary drives ordered.

Abroad, a 7,000 h.p. 50/120 r.p.m. blooming mill drive is now running in Australia, and a slightly smaller blooming mill drive and similar structural mill drives are now in service in Sweden.

Plant under erection includes a 7,000 h.p.

50/120 r.p.m. twin drive for a blooming mill abroad and a 14 motor Morgan rod mill drive, with rectifiers, in this country. Orders received include a 1,880 h.p. hot reversing mill motor to replace a Siemens motor supplied very many years ago.

The satisfactory progress made in connection with the mining industry is typified by the receipt of orders for winders and haulages, mainly for the National Coal Board. Although Ward Leonard winders in the 1,700/1,900 h.p. range form part of the business, a considerable number of geared a.c. winders, many fitted with the company's compensated system of d.c. dynamic braking, are included. The motor outputs range from 260 h.p. to 1,300 h.p.

Orders were also received for electric drives for the principal textile machinery makers and users. In the jute industry the most outstanding were those for motors and switchgear for the new spinning and weaving mills now being erected by the Pakistan Industrial Development Corporation. The 900 or so motors, totalling some 6,700 h.p., are required mainly for the individual driving of preparation spinning and finishing machinery. For ring spinning several orders were received for the L.V.R. variable speed spinning motor unit with its automatic spinning regulator. Other industries which placed important orders include cement, sugar and oil. One was the complete electrical equipment for a new oil refinery in South Africa.

In the traction field orders received include those for 2,000 h.p. 3,000 V d.c. locomotives for the South African Railways, 3,600 h.p. 3,000 V d.c. locomotives for the Spanish National Railways and flameproof battery locomotives for the N.C.B. Deliveries during the year include motor coach sets for British Railways and complete 800 h.p. 3,000V d.c. three-coach trains for Brazil. Diesel electric traction orders include 400 h.p. equipments for shunting locomotives for British Railways and 2,000 h.p. mixed traffic locomotives for Rhodesia.

In the marine field the Admiralty accepted the company's geared steam turbine designs for main propulsion duty in their latest submarine frigates.

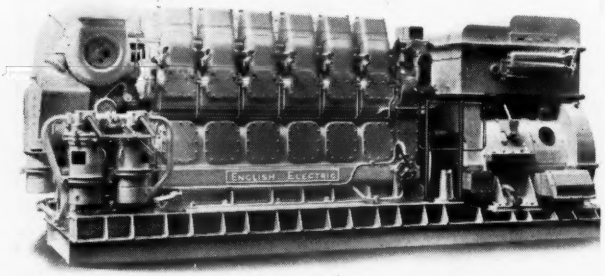
The demand was continued for the company's air-cooled steel tank mercury arc rectifiers, and among the more interesting orders was one for Norway for two 4,800 A 750 V grid controlled equipments to extend the aluminium capacity of Det Norsk Nitridaktieselskap. A range of electronic controllers has been established to cover d.c. motors of from 3 to 100 h.p. for variable speed driving applications. For f.h.p. d.c. motor drives the "Magamp" controller has been produced. This is a valveless unit using a magnetic amplifier.

Foremost in the welding development field is a new type of stepless control of arc welding current by means of ignitrons which provides a means of controlling on-load current without resorting to moving core or tapped reactors.

The Aircraft Electrical Equipment Division was busily engaged on the manufacture of rotary and linear actuators, lightweight motors, generators and invertors, and an improved design of actuator for heaver duty, with two speeds of operation, was introduced.

The year was one of consolidation in connection with television for the home market, with an eye to the future in regard to the possibility of new models in the lower price range, but the export market has not been overlooked.

The Domestic Appliance Division continued its manufacturing activities, although the sales of domestic appliances generally declined in both the home and export markets because of import restrictions, the continuation of the high rate of purchase tax and the more stringent hire-purchase regulations.



400 kW diesel-engine generator set as supplied to the Admiralty

ELECTRICITY SUPPLY

Use of Private Plant

Power Station Construction in 1952

THE British Electricity Authority announces that, as stated by the Minister of Fuel and Power on 24th November, the Electricity Boards intend to implement the recommendation of the Ridley Committee that restrictive conditions embodied in old contracts on the use and installation of private generating plant should be abandoned. Accordingly, if any consumer desires to use private plant and such use would contravene the provisions of his agreement with the Electricity Board concerned, the Board will be prepared to enter into a new contract which will reflect the costs of connecting and supplying the consumer while leaving him free to use the private plant.

Kafue Hydro-Electric Project

The report by the panel of consulting engineers appointed by the Northern Rhodesian Government to consider power development on the Kafue River has just been completed. The publication of the report will be of particular interest in view of the proposals for African federation which are under consideration.

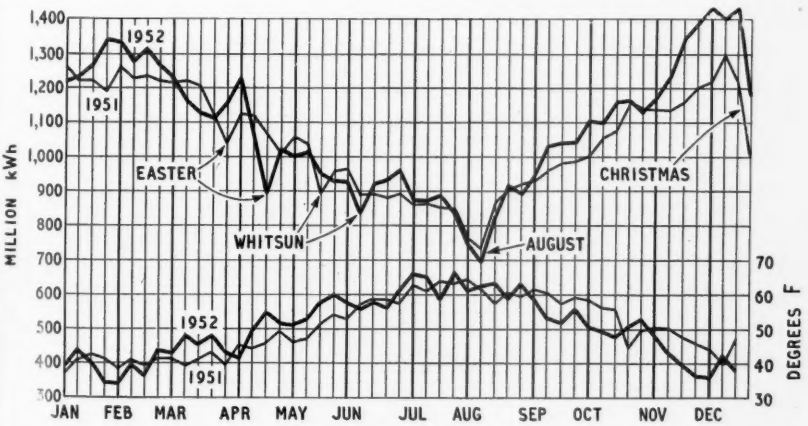
The panel of consulting engineers consisting of Mr. H. J. F. Gourlay, M.Eng., M.I.C.E., Sir William Halcrow, M.I.C.E., M.I.Mech.E., Mr. Geoffrey Kennedy, M.A., M.I.Mech.E., M.I.E.E., and Mr. C. H. Pickworth, M.I.Mech.E., M.I.E.E. is to assemble in Lusaka on 28th January to present the report to the Government. Owing to Mr. Gourlay's illness, Mr. E. C. Steer is representing him. The correspondent of *The Times* at Ndola states that the Kafue project, if approved, will be complementary to and will not replace the Kariba power scheme on the River Zambesi. A main consideration is that it promises power to the Copperbelt earlier than from the Kariba Gorge scheme.

Rewiring Municipal Buildings

A report to Middlesbrough Town Council from its consultants (R. W. Gregory and Partners, Newcastle-on-Tyne) regarding the electrical installation at the Municipal Buildings states that much of the installation is so old that its renewal is urgent. The consultants have been asked to prepare a scheme for renewing the electrical installation in stages.

Output in 1952

During the 52 weeks ended 26th December last a total of 56,499·0 million kWh was sent out for public supply from solid-fuel fired stations in this country, according to the weekly returns issued by the Ministry of Fuel and



Weekly electricity output (solid-fuel fired stations only) and average weekly temperature curves

Power. This compares with 54,786·2 million kWh in the 52 weeks ended 28th December, 1951, an increase last year of 3·1 per cent.

B.E.A. *Plant Contracts*

During the past month the British Electricity Authority has placed contracts for equipment for power stations, transforming stations, and transmission lines, amounting in the aggregate to £5,373,691. The principal contracts include the following:—

Marchwood power station, near Southampton: Condensing and feed heating plants for four 60 MW turbo-generator sets.—Hick, Hargreaves & Co., Ltd.

Brimsdown station, near Enfield: Four reinforced concrete housings for electrostatic precipitators and two natural draught reinforced concrete cooling towers and ponds.—Bierrum & Partners, Ltd.

Drakelow station, Burton-on-Trent: Additional works auxiliary switchgear.—A. Reyrolle & Co., Ltd.

Ince station, near Ellesmere Port: Two brick chimneys.—D. Theaker & Co., Ltd.

Wakefield station, Yorks: 132 kV 2,500 MVA switchgear.—A. Reyrolle & Co., Ltd.

Clyde's Mill station, Glasgow: Ash handling plant.—Babcock & Wilcox, Ltd.

Ince substation: Site and foundation works.—A. Monk & Co., Ltd.

Creyke Beck substation, Yorkshire: Site and foundation work.—George Houlton & Sons, Ltd.

Stella North substation, near Newcastle-upon-Tyne: Site and foundation works.—Sir Robert McAlpine & Sons, Ltd.

Carrington substation, near Manchester: 132 kV cables.—W. T. Glover & Co., Ltd.

Drakelow—Carrington (near Manchester): 275 kV twin 0·4 sq in overhead line.—British Insulated Callender's Construction Co., Ltd.

Orders have also been placed with the following companies for a number of diesel generating sets, to be installed in the stations indicated:—

Keadby (Scunthorpe)—Ferrybridge: 275 kV overhead line.—Watsham's, Ltd.

Mirrlees, Bickerton & Day, Ltd.: Two 2,000 kW sets (Walsall), three 1,330 kW sets (Lister Drive, Liverpool) and one 2,000 kW set (Macclesfield).

Ruston & Hornsby, Ltd.: One 1,040 kW set (Basingstoke).

English Electric Co., Ltd.: One 950 kW set (Clacton) and two 950 kW sets (Southend).

Supplies to Houses

Felling (Co. Durham) Urban Council is seeking loan sanction for £3,378 for the installation of electricity in 139 houses on the Stoneygate Lane Estate.

POWER STATION CONSTRUCTION

The plants listed below, complete with all associated ancillary equipment, were commissioned in 1952

Station	B.E.A. Divisions	Turbo-Generators		Boilers		Main H.P. Pipework
		Installed Capacity (MW)	Makers	Capacity (k lb hr)	Makers	Makers
BANKSIDE* ..	London	1 × 60	B.T.H.	2 × 375	Foster Wheeler	Parsons
BARKING "C"* ..	London	1 × 75	B.T.H.	—	—	Aiton
BATTERSEA "B" ..	London	—	—	2 × 425	B. & W.	Aiton
BLACKBURN ..	North Western	1 × 40	English Elec.	3 × 150	Simon-Carves	B. & W.
BLACKWALL POINT	London	1 × 30	English Elec.	1 × 365	B. & W.	B. & W.
BRAEHEAD	S.W. Scotland	1 × 50	Parsons	2 × 300	B. & W.	B. & W.
BRIGHTON "B"*	South Eastern	1 × 52	Richardsons Westgarth	2 × 320	B. & W.	Parsons
BROMBOROUGH ..	Merseyside & N. Wales	2 × 50	English Elec.	2 × 300	B. & W.	Stewarts & Ll.
BRUNSWICK WHARF*	London	2 × 52	Metro.-Vickers	4 × 320	Clarke Chapman	Parsons
CLARENCE DOCK	Merseyside & N. Wales	—	—	2 × 350	Babcock & Wilcox	Stewarts & Ll.
CLIFF QUAY ..	Eastern	1 × 45	Metro.-Vickers	—	—	Aiton
CROYDON "B" ..	South Eastern	—	—	2 × 320	Simon-Carves	Aiton
DEPTFORD EAST ..	London	—	—	1 × 250	Foster Wheeler	Thompson
HUNCOAT*	North Western	2 × 30	G.E.C.	2 × 305	Simon-Carves	Parsons
KEADBY	Yorkshire	2 × 60	Parsons	1 × 550	Stirling	Parsons
LITTLEBROOK "C"*	South Eastern	1 × 60	Parsons	2 × 360	Int. Combustion	Parsons
NECHELLS "B" ..	Midlands	1 × 52	Parsons	3 × 230	Int. Combustion	Stewarts & Ll.
NORTHAMPTON ..	East Midlands	1 × 30	Parsons	2 × 190	Simon-Carves	Stewarts & Ll.
NORTH TEES "C"	North Eastern	2 × 60	Parsons	2 × 360	B. & W.	B. & W.
PLYMOUTH "B" ..	South Western	2 × 31	Metro.-Vickers	2 × 320	Yarrow	B. & W.
POOLE	Southern	1 × 50	Parsons	2 × 300	Int. Combustion	Aiton
PORTSMOUTH ..	Southern	1 × 30	B.T.H.	2 × 180	Mitchell	Parsons
ROTHERHAM ..	Yorkshire	—	—	1 × 200	Int. Combustion	Stewarts & Ll.
RYE HOUSE ..	Eastern	1 × 32	Richardsons Westgarth/ Parsons	1 × 350	B. & W.	Stewarts & Ll.
SKELTON GRANGE	Yorkshire	1 × 60	Parsons	2 × 360	Int. Combustion	Aiton
STAYTHORPE ..	East Midlands	1 × 60	B.T.H.	3 × 240	B. & W.	Aiton
THORNHILL ..	Yorkshire	1 × 45	English Elec.	1 × 180	Mitchell	Stewarts & Ll.
USKMOUTH* ..	South Wales	1 × 60	G.E.C.	2 × 360	B. & W.	Aiton
WARRINGTON ..	Merseyside & N. Wales	1 × 30	Brush Elec.	1 × 200	Simon-Carves	Parsons
WEST HAM "B" ..	London	2 × 30	English Elec.	3 × 180	Thompson	Aiton
WESTWOOD ..	North Western	1 × 30	B.T.H.	2 × 300	B. & W.	Stewarts & Ll.
WOOLWICH	London	1 × 30	G.E.C.	2 × 180	Thompson	Parsons

* New stations, in which plant was commissioned for the first time.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Shuttered Socket Outlets

IT is announced that a range of three-pin 13 A fused plugs and shuttered socket outlets is now available from BILL SWITCHGEAR, LTD., Aston Lane, Perry Barr, Birmingham, 20. The fused plugs are all the same but the flush mounting socket outlet is available with or without a switch. Other models include a surface mounting socket outlet and a two-gang flush fixing model. Spare cartridge fuses and metal or wood single and double boxes can be supplied with them.

Bulkhead Lighting Fittings

We are informed that the "Diolux," "Diolume" and "Diopal" prismatic bulkhead lighting fittings made by DORMAN & SMITH, LTD., Ordsal Electric Works, Manchester, 5, are all of silicon alloy diecast construction which makes them suitable for installation in salt-laden atmospheres.

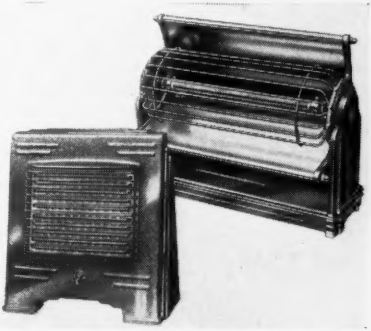
Improved Switches

Until recently, in all standard switches made by J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall, Staffs, the moving contacts were insulated from the switch mechanism by mica but in future moulded nylon is to be used which, apart from simplifying assembly, will offer superior electrical characteristics.

As so many switches are involved the changeover to the new form will take some time before it is completed. At first only the 5 A switches will incorporate these patented nylon contact carriers; there will be no change in list numbers.

Re-introduced Fires

Following upon the removal of restrictions upon the manufacture of a number of domestic appliances, the MIDLAND ELECTRIC MANUFACTURING CO., LTD., is re-entering the electric fire business. Two new models are being introduced,



"Mayfair" and "Memray" fires

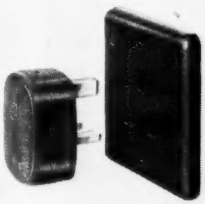
the "Memray" swivel reflector type and the "Mayfair" flat-bar pattern in 1 and 2 kW sizes.

Time Delay Relay

A mechanical time delay relay introduced by ELECTRO METHODS, LTD., 220, The Vale,

(1) Bill Switchgear 13 A fused plug and socket outlet. (2) Crabtree switch mechanism with *(left)* mica and *(right)* nylon contact insulation. (3) Electro Methods mechanical time delay relay

1



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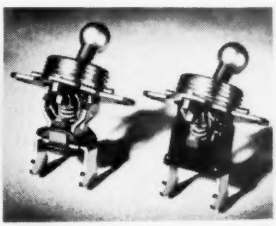

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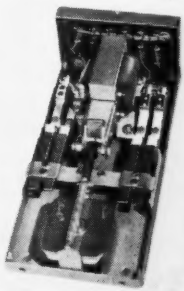


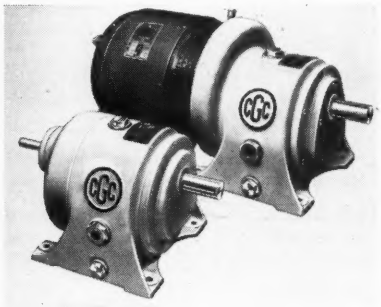
London, N.W.11, is a robust and compact piece of apparatus comprising a mechanical escapement, actuated by a solenoid, directly coupled to four insulated fingers which in turn control the action of four sets of changeover contacts. Each finger can be independently adjusted to operate its respective set of contacts at any period within the time cycle. The contact rating is 5 A at 250 V a.c. and the solenoid can be supplied to operate at from 4 V to 440 V a.c. or 5 V to 250 V d.c. The time delay ranges available are 1 sec to 1 min and 5 sec to 4 min according to the type of relay chosen, the accuracy being 10 per cent or better.

Fish Cabinet

In the description of the Prestcold F.C.103 fish cabinet which appeared in the *Electrical Review* of 26th December (page 1407) it was erroneously stated that the refrigeration unit was of the absorption type. Actually the "Presmetic" refrigeration unit incorporates a single cylinder compressor with a $\frac{1}{8}$ h.p. split-phase motor hermetically sealed in a steel housing, and it is guaranteed for five years.

Geared Motors

The latest addition to the range of geared motors made by the COVENTRY GEAR CO., Foleshill, Coventry, is known as the Size 3 model, and it is available in either double or triple reduction form. With a motor speed of 1,425 r.p.m., a choice of 17 output speeds, ranging from 25 to 345 r.p.m., is available, with an equivalent variation of input powers from 1·25 to 5 h.p. The weight, excluding motor, of the double reduction unit is 105 lb and of the triple reduction unit 110 lb. Any type of motor up to 14in diameter may be fitted to suit individual requirements and the gear units are also available without motors. In such cases, the motor adaptors are replaced by modified covers, and the input and output shafts are coaxial.



Above: **Coventry Size 3 geared motor and reduction gear unit**

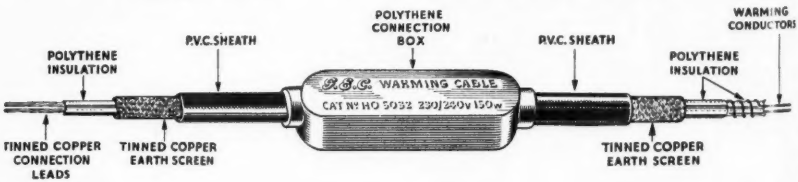
Below: **New G.E.C. transformerless soil warming cable and connector box between the tails and warming conductors**

Fast Charger and Engine Starter

It is claimed by CRYPTON EQUIPMENT, LTD., Bridgwater, Somerset, that a vehicle with a completely "flat" battery can be started in one to five minutes with the aid of its new fast charger and engine starter. This portable equipment is a simplified and cheaper model of the company's fast charger analyser but it produces the same full rate of charging output of 100 A for 6 V batteries and 80 A for 12 V batteries. It can also be used for battery boosting and slow charging. The price for a 200/250 V a.c. operated model is £85, the slow rate charging panel being 50s extra.

Cheaper Soil Warming

Electric soil warming can be less costly now that the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has introduced warming cables that can be used without a transformer. They comprise polythene insulated twin resistance wires sheathed with a braided metal earth screen, the screen being protected by a p.v.c. covering. The final 6ft of the cable contains twin copper leads for connection to the electricity supply. The earth screen, which extends throughout the whole length of the cable and tail, is not only a protection in the event of electrical failure but is also a safeguard against damage by impact such as a blow by a spade. When the sheathing is cut back the conductors and earth screen are exposed. The screen may be clamped to an earth connection, or a short length unravelled and twisted for insertion into an earth terminal. Cables for two loadings are available, one at 150 W, supplied in a 40ft length, the other at 300 W, supplied in an 80ft length. They are intended for use on 220/240 V a.c. or d.c. mains.



Japanese Electrical Industry

Factors Aiding Revival

By R. E. KAAN, Dipl. Ing.

AFTER five years' occupation the Japanese political and economic structure, with the financial and technical assistance of the United States, has now recovered from its prostration in 1945. On 1st May, 1951, the Japanese electrical industry started anew under indigenous management and since then has shown steady development. This revival, as in the case of Germany,* may be attributed to lower wages, freedom of the engineering industries from defence commitments, less raw material limitations, long credit terms, keener prices and in some instances quicker delivery.

The loss of markets in China and other Asiatic countries has brought about a radical change in Japan's pattern of foreign trade. The Japanese are one of the most industrious nations of the East, more prone to act by imitation than by conviction, and in order to regain technical efficiency the electrical industry, supported by local authorities and associations, has taken advantage of every opportunity to import advanced technical knowledge and practice into the country. Many technical co-operation agreements with foreign countries, trade missions and trade fairs serve the same purpose.

Though the growth of Japan's electrical exports (Fig. 1) is less impressive than the German, it is spectacular in view of Japan's limited productive capacity. The direction of exports to vital United Kingdom markets, such as India and Pakistan, is noticeable in the table.

Destinations of Japanese 1951 exports of electrical machinery, apparatus and appliances

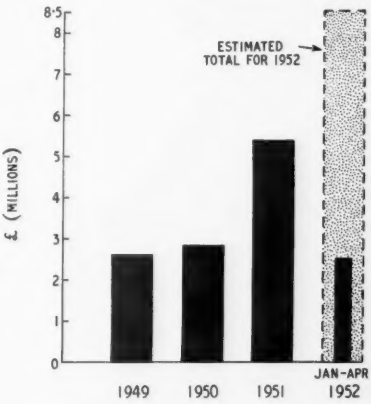
Country	Total value
India	£280,769
Formosa	£269,023
Pakistan	£221,820
Okinawa	£166,493
Argentina	£100,102
Siam	£ 96,429
Philippines	£ 71,780
Brazil	£ 30,103
Hong Kong	£ 22,127
Malaya	£ 13,956

Japan increased her total electrical exports from £2·83 million in 1950 to £5·3 million in 1951 (about 89 per cent) against Germany's £26·2 to £56·3 million (about 117 per cent) for the same period. It can be assumed that the total electrical export figure for 1952 will reach £8·6 million (an increase of about 63 per cent compared with the 1951 figure).

An analysis of exports of motors and generators, transformers and switchgear is given in Fig. 2. While Japan achieved an export increase at the end of 1951 of approximately 25 per cent over the 1938 figure for motors and generators, the corresponding figure for transformers was a mere 6 per cent.

The necessity to harness the abundant

Fig. 1—Annual exports from Japan of electrical machinery and apparatus



* An article on German competition appeared in the *Electrical Review* of 19th December.

water supply in Japan's mountainous areas helped to foster the spectacular revival of the country's heavy plant industry. To meet the increasing need, expansion plans both for power capacity and generator production up to 1956 were drawn up (Fig. 3).

In order to regain the ground lost during the war years the most important Japanese power plant manufacturers concluded technical co-operation agreements with many foreign firms. These include the Westinghouse International Co., International General Electric Co., International Standard Electric Co., Western Electric Co., Gould-National Battery Co. (all of the United States), Escher-Wyss (Switzerland), and Siemens-Schuckertwerke, A.G., Allgemeine Elektrizitäts-Gesellschaft and Voith (all of Germany).

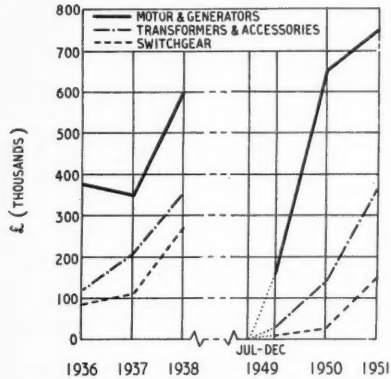


Fig. 2—Broad analysis of Japanese exports 1936-38 and 1949-51

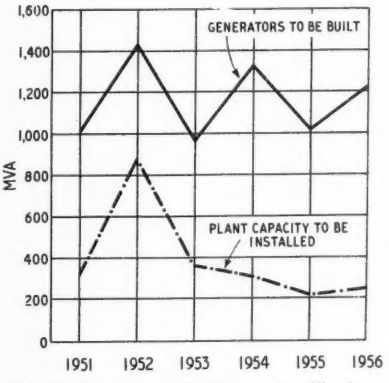


Fig. 3—Japanese production and utilization plans 1951-56

Serious efforts are being made to rehabilitate the motor industry to restore it to pre-war efficiency. Japanese firms succeeded in 1951 in exporting turbo-generators to traditional United Kingdom markets in the Commonwealth countries.

There are at present 270 manufacturers in Japan producing telecommunication, radio and television equipment.

Japan, working on foreign designs and under United States patents, is likely to become a serious competitor in the future. She will do her utmost to get a firm grip on the world markets by price cutting, promises of speedy delivery, extension of technical help and machinery to under-developed countries, promoting sample fairs in overseas markets, re-opening of trade offices and introducing more up-to-date industrial techniques.

Cooking in Malaya

NEW power stations in Malaya shortly to be opened, one in the Connaught Bridge area, Kuala Lumpur, and another at Pasir Panjang, Singapore, will provide adequate electricity for domestic use. Already the clay-lined charcoal bucket, shaped to take the *kwali*, the traditional round-bottomed Malay utensil for cooking rice, may soon be superseded by a standard British electric cooker with specially designed radiant hot-plates dished to the contour of the *kwali* and fitted with control devices for simmering purposes.

The Singapore City Council has ordered 500 of these new specially designed G.E.C. "Eastern" cookers, and will hire them to the population which is mainly Malay, Chinese and Indian. A further 500 will be marketed by the General Electric Co. in Malaya and sample cookers are also being sent to Hong Kong where rice is cooked in the same way. To teach electric cooking to the Malays the G.E.C. is sending to Malaya Mrs. E. Picton-Howell, a demonstrator conversant with the Malayan languages and with the preparation of traditional Chinese and Malay dishes. She will give cooking demonstrations at the Central Electricity Board showrooms.

The cookers have a modified hob structure which accommodates two 12in diameter *kwalis*, or one *kwali* and a solid boiling plate, all elements being simmer-switch controlled. There is no grill-boiler but there is a large warming compartment and a standard oven, below which is a heated drawer.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Scottish Cables (South Africa), Ltd.—The annual meeting was held on 29th December at Pietermaritzburg, Mr. W. Fraser (chairman) presiding. In presenting the report and accounts, Mr. Fraser said that during the year under review there had been a noticeable improvement in the supply of raw materials, and this improvement had continued since the close of the year. Many important contracts had been carried out for power distribution cables and all classes of rubber-insulated cables for Government Departments, including the Electricity Supply Commission, the South African Railways and Harbours, Departments of Posts and Telegraphs and Public Works Departments. They commenced the current year with excellent order books.

W. T. Henley's Telegraph Works Co., Ltd., announces that at the extraordinary general meeting held on 31st December, resolutions were passed capitalizing £2,437,500 of the share premium account, increasing the authorized capital from £2,650,000 to £5,100,000 and raising the issued ordinary capital from £2,437,500 to £4,875,000. In future the nominal amount of each stock unit will be 10s instead of 5s as heretofore.

The Perak River Hydro-Electric Power Co., Ltd., announces that, the arrears of dividend on the 5 per cent cumulative preference share capital having been paid, future dividends will be payable half yearly in equal instalments on 31st January and 31st July in each year, instead of on 1st April and 1st October as heretofore, the next payment being on 31st January, in respect of the half year ended on that date.

New Companies

Lawson & Parsons, Ltd.—Registered 30th December. Capital £3,000. To acquire the business of an electronic engineer carried on by G. R. Lawson at Thompsons Yard, Witham, Essex, as G. R. Lawson & Co. Directors: G. R. Lawson and M. L. Parsons. Regd. office: Colne House, Guithavon Street, Witham.

Thomas A. Chapman, Ltd.—Registered 19th December. Capital £2,000. Wholesalers, retailers, manufacturers and dealers in electric lamps and cables of all kinds, wireless and television instruments, etc. Directors: T. A. Chapman and P. T. Chapman. Secretary: P. T. Chapman. Regd. office: 2, Endsleigh Street, W.C.1.

R. A. Hall & Co., Ltd.—Registered 17th December. Capital £200. Electrical and electronic engineers and contractors, etc. Directors: R. A. Hall and A. Bentham. Regd. office: 53, Wood Street, Chestergate, Stockport.

Kubice, Ltd.—Registered 20th December. Capital £2,000. Refrigeration engineers and contractors, etc. Directors: J. R. Phillips and Kathleen Petty. Secretary: J. R. Phillips. Regd. office: 4, Bucklersbury, E.C.4.

Dalmere Electronics, Ltd.—Registered 23rd December. Capital £3,000. To exploit electronic techniques, etc. Directors: T. M. Dunnabeck and T. Hayhurst. Regd. office: Dunnabeck, White Moss, Grasmere, Westmorland.

Liquidations

T. E. & J. Hill, Ltd., sanitary and electrical engineers, Reliance Works, Steelhouse Lane, Birmingham.—Winding up voluntarily. Liquidator, Mr. H. R. Stredder, 5, St. Philips Place, Birmingham, 3, appointed 19th December. Particulars of claims to the liquidator by 28th February.

Cumbrian Electrical Co., Ltd.—Meetings 4th February at Midland Bank Chambers, Penrith, to receive an account of the winding-up by the liquidator, Mr. F. Kenyon.

Bankruptcies

C. A. Whittington, carrying on business at 400, Abbeydale Road, Sheffield, electrician and wireless dealer.—Bankrupt discharged as from 27th December, 1952.

J. G. Elvidge, carrying on business at 31, Wincheap, Canterbury, electrical contractor.—Trustee, Mr. E. C. Williams, Midland Bank Chambers, High Street, Herne Bay, Kent, appointed 24th December.

F. J. Hocken, formerly carrying on business at 19, Vere Street, Cadoxton, Barry, Glam, under the style of "Auto-Electric Services," as an electrical retailer and contractor.—First meeting 13th January at 34, Park Place, Cardiff. Public examination 4th March at the Law Courts, Cathays Park, Cardiff.

STOCKS and SHARES

QUIETLY firm conditions characterized most sections of the Stock Exchange at the opening of the New Year, denoting underlying confidence in the plans made for the restoration of the Commonwealth's economic health, and sober appreciation of the difficulties and readjustments to be negotiated on the way. Gilt-edged stocks show scarcely a quotable change over the past week. Industrial markets are not entirely lacking in good features. Among electrical shares, Automatic Telephones, Brook Motors and Mather & Platt show gains, while Chloride Electrics are particularly strong at 65s, a price higher than the best recorded in 1952. That distinction is shared, incidentally, by C. A. Parsons and B.I.C.C. Others very near it include English Electric, Babcocks, Lucas, and Reyrolle.

Murex New Shares

The 200,000 new shares offered to Murex stockholders last month at 48s are quoted now at about 55s 3d and will be available free of transfer stamp duty until the 21st of this month, the final date for the renunciation of allotments. It may be noted that a capital issue for cash by Murex is a rare event. The company's record is distinguished by the scale upon which expansion has been financed out of retained profits and internal resources, a process made progressively more difficult by the drain of taxation. The directors expect to be able to maintain the dividend at last year's rate of 15 per cent on the larger capital. In declaring recently an interim dividend of 6 per cent, they said that disregarding the fortuitous stock profits which added substantially to the profits of the two previous years, results for the first half of the current year were up to the figures for 1951.

Electrical Equipment

The best favoured and most freely marketable ordinary shares in the electrical equipment and engineering market have started the year on a yield basis of around 5½ per cent, calculated on dividends relating mainly to 1951. A yield of that order is just about 1 per cent above the present return from War Loan, and may be taken as a token of confidence in the annual results and dividend decisions which will begin to make their appearance in bulk in three or four months' time. While company news and trade reports concerning some sections of the industrial market have raised a good deal of apprehension about the results for 1952, investment continues to demonstrate its faith in electrical engineering as being among the most reliable and progressive fields for the employment of capital. It may be further said that few others contain so high a proportion of companies complying with the specification of what the Stock Exchange calls a "blue-chip" industrial.

Higher Yields

The investor wanting a higher prospective return on his money than the 5½ per cent available from the industrial market leaders continues to have a wide range of electrical ordinary shares for consideration. Investments showing prospective returns of between 6 and 7 per cent include the ordinary shares of Aberdare Cables, Crompton Parkinson, Decca, Ever Ready, Hackbridge & Hewittic, and Revo Electric. Yields of 7 to 8 per cent are shown on such shares as E. K. Cole, Falk Stadelmann, Hoover, Switchgear & Cowans, Thorn Electric, and Allen West. Shares on a yield basis on or over the 8 per cent mark include Aron Electric, Aerialite, Brush, E.M.I., Hackbridge Cable, Hall Telephone, Holophane and Strand Electric.

Twelve Months' Fluctuations

Comparisons were made here last week between quotations at the beginning and end of 1952 in the case of representative groups of electrical investments. By way of supplement, the table below is given to compare present prices with the highest and the lowest quotations over the past twelve months. As a generalization it can be said that security prices were at their best at the beginning of the period, and reached their nadir in June. The following figures are impressive in illustrating the strength of the revival from a depression which seemed, at one time, to be reaching grave proportions.

Stock	Price 1952		Present Price
	High	Low	
3 per cent British Electricity 1968/73	85⅜	78⅞	81
3½ per cent British Electricity 1976/79	91	84⅜	89
A.E.I.	84/-	66/-	75/-
Crabtree	36/-	30/-	31/3
Crompton Parkinson ..	9/9	7/3	8/9
English Electric	59/-	50/3	59/-
G.E.C.	46/-	35/9	42/6
Auto. Telephone	62/-	50/3	60/-
B.I.C.C.	33/9	24/6	34/-
Henley's	20/6	14/6	19/-
Siemens	43/6	28/-	34/6
Johnson & P.	55/-	45/-	52/-
Cole, E. K.	17/7	13/6	17/-
Cossor	13/6	8/-	9/6
E.M.I.	18/9	13/-	13/3
Babcock & Wilcox ..	72/6	59/3	71/-
Chloride Electric	63/3	52/6	65/-
Ever Ready	27/9	20/9	26/3
Hoover	27/9	21/-	23/9
Lucas	36/9	28/6	36/3
Murex	57/3	42/6	55/-
Parsons	54/3	45/-	55/-
Reyrolle	51/6	37/6	51/3
Westinghouse	53/6	43/9	50/9

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 5th Jan. 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	84	—	3	11	6
Brit. Elec. 1974/77	3	3	83	—	3	12	3
Brit. Elec. 1976/79	3½	3½	89	—	3	18	8
Brit. Elec. 1974/79	—	4½	100	—	4	5	8
Calcutta Elec. ..	6†	6†	20/-	—	6	0	0†
East African Power	7	7	23/-	+6d	6	1	9
Nigerian Elec. ..	10	10	21/3	—		—	
Palestine Elec. "A"	5†	Nil	9/-	−1/-		—	
Perak Hydro-Elec.	Nil	Nil	14/6	+6d		Nil	
Equipment and Manufacturing							
AberdareCables(5/-)	20	20	14/9	—	6	15	6
Aerialite (1/-) ..	83½	88½	8/6	—	10	7	9
Allen, W. H. ..	15	15	41/9	—		—	
Aron Elec. Ord. ..	15	15	37/6	—	8	0	0
Assoc. Elec. Ord...	20	20	75/-	—	5	6	8
Automatic Tel. & El.	15	15	60/-	+⅛	5	0	0
Babcock & Wilcox	18	18	71/-	+6d	5	1	6
Baldwin, H. J. (2/-)	25	20	3/6	—	11	8	9
Bakelite (10/-) ..	—	—	16/3	—		—	
British Aluminium	10	12	43/3	—	5	10	10
B.I. Callender's ..	7½	9	34/-xd	+9d	5	6	0
British Thermostat (5/-)	30	30	28/9	—	5	4	3
British Vac. Cleaner (5/-)	25	25	13/6	—	9	5	2
Brook Motors (10/-)	20	20	32/6	+⅛	6	3	1
Brush Ord. (5/-) ..	10	10	5/-	—	10	0	0
A. F. Bulgin (1/-)..	27½	30	2/7½	—	11	8	6
Burco (5/-) ..	38½	35	18/9	—	9	6	9
Chloride El. Storage	15	15	65/-	+¼	4	12	4
Cole, E. K. (5/-) ..	25	25*	17/-	+3d	7	7	1
Cossor, A. C. (5/-)	Nil	10	9/6	+3d	5	5	3
Crabtree (10/-) ..	17½	17½	31/3	—	5	12	0
Crompton Parkinson Ord. (5/-) ..	11½	11½	8/9	—	6	8	6
De La Rue (5/-) ..	50	35*	9/-	+6d		—	
Decca (1/-) ..	112½	112½	18/-	+3d	6	5	0
Dewhurst (2/-) ..	22½	19*	5/-	—	7	12	0
Dictograph Tel. (2/-)	20	20	5/-	—	8	0	0
E.M.I. (10/-) ..	12	12	13/3	—	9	1	2
Electrical Components (5/-) ..	20	20	10/-	—	10	0	0
Elec. Construction	15	15	50/-	—	6	0	0
Enfield Cable Ord.	7½	7½	22/-	—	6	16	4
English Electric ..	15	15	59/-	—	5	1	8
Ericsson Tel. (5/-)	22†	22*†	41/6	+9d	2	13	0†
Ever Ready (5/-)..	35	35	26/3	+3d	6	13	3
Falk Stadelmann:.	15	15	38/9	—	7	14	8
G.E.C. Ord. ..	22½	22½	42/6	—	5	6	0*
General Cables (5/-)	30	30	15/-	—	10	0	0
Greenwood & Batley	15	15	38/-	—	7	18	0
Hackbridge Cable (5/-)	20	20	10/3	—	9	15	0
Hackbridge Hewittic (5/-)	18	20	16/3	—	6	3	0
Hall Tel. Acc. (10/-)	10	10	9/3	—	10	16	2
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (5/-) ..	20	20	19/-	+3d	5	5	3
Holophane (5/-) ..	15	20*	11/3	—	8	17	10
Hoover (5/-) ..	37½	35*	23/9	+6d	7	7	4

Company	Dividend Previous	Dividend Last	Middle Price 5th Jan. 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	20	25	12/3	+3d		—	
Johnson & Phillips	15	15	52/-	—	5	15	5
Lancashire Dynamo	22½	12½*	42/6	—	5	17	8
Laurence,Scott(5/-)	12½	15	13/3	—	5	13	3
London Elec. Wire	12½	12½	51/3	—	4	17	6
J. Lucas	7½	9½	36/3	—	5	1	3
Marryat & S. (2/-)	22½	22½	5/-	—	9	0	0
Mather & Platt ..	12½	12½	42/-	+⅛	5	19	0
Metal Industries ..	10	15	40/9	—		—	
Mid. Elec. Mfg. ..	15	15	55/-	—	5	9	1
Murex	12½	15	55/-xd	—	5	9	0
Newman Ind. (2/-)	6	10	2/3	—	8	17	10
Oldham & Son (1/-)	30	35	2/6	—		—	
Parnall (Yate) (5/-)	6	6	3/9	—	8	0	0
Parsons, C. A. ..	15	10*	55/-	—		—	
Plessey (5/-) ..	22½	25	21/3	—	5	17	9
Pye Deferred (5/-)	18	18	16/-	+6d		—	
Revo (10/-) ..	27½	27½	42/6	—	6	9	6
Reyrolle	15	10*	51/3	—		—	
Scot. Cable (4/-) ..	30	32	11/3	—		—	
Siemens Ord. ..	10	10	34/6	—	5	16	0
Strand Elec. (5/-)..	17½	17½	8/9	—	10	0	0
Sturtevant (5/-) ..	16½†	17½*†	24/6	+6d		—	
Switchgear&Cowans (5/-)	22½	22½	15/6	—	7	5	3
Taylor T. (5/-) ..	20	20	19/3	—	5	4	0
T.C.C. (10/-) ..	20	20*	38/-	—		—	
T.C. & M... ..	10	10	26/-	—		—	
TelephoneMfr.(5/-)	10	10	8/-	—		—	
Thorn. Elec. (5/-)..	10	12½	8/-	—	7	10	3
Tube Investments	25	15*	60/3	—	4	19	6
Vactric (5/-) ..	Nil	Nil	4/6	—		Nil	
Veritys (5/-) ..	Nil	7½	4/9	—	7	18	0
Walsall Conduits (4/-)	70	70	46/-	—		—	
Ward & Goldstone (5/-)	45	45*	30/9	—		—	
Watford (2/-) ..	25	25	6/3	—	8	0	0
Westinghouse Brake	14	14	50/9	—	5	10	3
West, Allen (5/-) ..	12½	15	10/3	—	7	6	4
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord. ..	—	6	79½	—	7	11	0
Ord.	—	3¾	55	—	6	16	3
Anglo-Portuguese	8	8	20/6	-	7	16	1
Brit.Elec.Traction: Def. Ord. ..	22½	25	125	—	5	17	8
Cable & Wireless: Ord.	6	8	126½	—	6	6	6
4% Loan ..	4	4	94½	—	4	4	9
Calcutta Trams ..	6†	6†	22/6	−6d	5	6	8†
Cape Elec. Trams	5	5½	10/-	—	11	0	0
Marconi Marine ..	10	10	30/6	—	6	11	3
Oriental Tel. Ord.	16	16	58/6	—		—	
Telephone Props...	8	8	32/6	—	4	18	6
Tele. Rentals (5/-)	10	10	9/-	+9d	5	11	1

* After capital bonus.
† Dividends are paid free of Income Tax.

NEXT WEEK'S EVENTS

Monday, 12th January

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.E. South Midland Supply and Utilization Group. "Performance of Natural Draught Water Cooling Towers," by H. Chilton.

Grand Hotel. Institution of Heating and Ventilating Engineers, Birmingham and District Branch. Ladies' evening.

DUNDEE.—Mathers Hotel, 7.30 p.m. Incorporated Plant Engineers, Dundee Branch. "Electricity in the Textile Industry," by J. D. Campbell.

KINGSBURY.—Prince of Wales Hotel, 8 p.m. A.S.E.E. North-West London Branch. "Industrial X-Ray Equipment," by F. L. Veale.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. Film evening.

Falk Stadelmann Showrooms, 20, Mount Street, Park Lane, W.1, 7 p.m. A.S.E.E. Central London Branch. Discussion on Coronation lighting, followed by tour and inspection of the showrooms.

SHEFFIELD.—The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. Presidential address, by W. J. Wellwood Ferguson.

Tuesday, 13th January

BELFAST.—Presbyterian Hostel, Howard Street, 6.45 p.m. I.E.E. Northern Ireland Centre. "Technical Colleges and Education for the Electrical Industry," by Dr. H. L. Haslegrave.

BOLTON.—Balmoral Hotel, Bradshawgate, 7.30 p.m. A.S.E.E. Bolton Branch. "Industrial Switchgear," by A. T. Crawford.

GLASGOW.—Burlington, Bath Street, 7.30 p.m. Institution of Heating and Ventilating Engineers, Scottish Branch. Annual dinner and ladies' night.

HULL.—Y.E.B., Ferensway, 7.15 p.m. I.E.E. North Midland Centre. District meeting. "Electricity Supply and Management," by C. Cameron Kirby.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Students' Section. Centre chairman's address, by H. S. Moody.

LONDON.—Criterion Restaurant. I.E.E. Utilization Section. Dinner-dance.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Power Station Lighting," by P. D. Figgis.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "Performance of Natural Draught Water Cooling Towers," by H. Chilton.

Engineers' Club, Albert Square, 7.15 p.m. Incorporated Plant Engineers, East Lancashire Branch. Open meeting.

NEWPORT.—Tredegar Arms Hotel, 7 p.m. Newport and District Electric Club. "Modern Trend in Steel Works Electrics," by A. W. Ellis.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Television Programme Origination: the Engineering Technique," by D. C. Birkinshaw. (Joint meeting with the Rugby Students' Section.)

Wednesday, 14th January

BRADFORD.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Further Applications of X-Rays," by Mr. Hudson.

FARNBOROUGH.—R.A.F. College, 7.30 p.m. I.E.E. Southern Centre. District meeting.

HUDDERSFIELD.—Electricity Showroom, Market Street, 7.15 p.m. I.E.S. Huddersfield Group. "New Applications of Fluorescent Lamps, including Stage Lighting," by J. W. Strange.

LANCASTER.—N.W.E.B. Demonstration Theatre, North Road, 7 p.m. I.E.E. North Lancashire Sub-Centre. "Modern Developments in Electric Welding," by Dr. H. G. Taylor.

LIVERPOOL.—Philharmonic Hall, 6.45 p.m. I.E.E. Mersey and North Wales Centre. Faraday Lecture. "Light from the Dark Ages or the Evolution of Electricity Supply," by A. R. Cooper.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. "Printed and Potted Electronic Circuits," by G. W. A. Dummer and D. L. Johnston.

I.E.E. London Students' Section, 1.45 p.m. Visit to Evershed and Vignoles, Ltd., Chiswick.

Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "Telephone Call Office Maintenance," by H. C. L. Grafton.

At the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. Institution of Locomotive Engineers. "Limitations on Train Performance with Electric Traction," by A. S. Robertson.

NOTTINGHAM.—Welbeck Hotel, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. "Peak Steam Demands and Thermal Storage," by Dr. E. G. Ritchie.

OXFORD.—37, George Street, 7 p.m. I.E.E. District meeting. "The Trend of Technical Education," by J. H. Brookes.

Thursday, 15th January

BIRMINGHAM.—Grand Hotel, Colmore Row, 7 for 7.30 p.m. Institute of Metal Finishing, Midlands Branch. Annual dinner-dance.

BLACKBURN.—Chamber of Commerce, Richmond Terrace, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. "Induction Generation by Back-Pressure Equipment."

CARDIFF.—Park Hotel, 6.30 for 7 p.m. South Wales Institute of Engineers. Annual dinner.

EXETER.—Imperial Hotel. Exeter Electric Club. "Newspaper Production," by H. P. Twyford.

GLOUCESTER.—2, St. Aldate Street, 6.15 p.m. I.E.S. Gloucester and Cheltenham Centre. "Electric Organisms and Living Light," by J. Ashmore.

LIVERPOOL.—At the N.W.E.B. Service Centre, Whitechapel, 7 p.m. British Institution of Radio Engineers, Merseyside Section. "Design and Application of Quartz Crystals," by R. A. Spears.

LONDON.—Caxton Hall, Westminster, 2.30 p.m. Diesel Engine Users' Association. "Small Air-Cooled Diesel Engines—Development and Applications," by C. F. Nossiter.

MAIDSTONE.—Royal Star Hotel, 8 p.m. A.S.E.E. Kent Branch. "Estimating for Electrical Contractors," by W. H. Brooks.

NOTTINGHAM.—Gas Showrooms, Parliament Street, 6.30 p.m. Institution of Heating and Ventilating Engineers, East Midlands Branch. "An Investigation into Whole House Heating," by Dr. J. C. Weston.

Friday, 16th January

BIRMINGHAM.—Imperial Hotel, 7.30 p.m. Incorporated Plant Engineers, Birmingham Branch. Contractors' Plant Discussion Group.

LEWISHAM.—S.E. London Technical College, 8 p.m. A.S.E.E. South-East London Branch. "Supervising Equipment," by V. L. Batchelor.

Saturday, 17th January

LONDON.—I.E.E. London Students' Section, 10.30 a.m. Visit to Big Ben clock tower.

MARTINDALE

hot air on tap

Martindale Hot Air Blowers, in powers from 500 — 3,000 watts, are ideal for the quick drying of windings of all kinds before and after varnishing, and for many other purposes connected with the electrical industry. Can be used with the heat off as blowers for dust removal and vacuum cleaning.

MARTINDALE ELECTRIC CO. LTD.

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5-250 *Amps*
2 *pole and* 3 *pole*
with scraping earth connections

OFF THE SHELF SERVICE FOR REYROLLE METALCLAD FITTINGS

One of the many coupling arrangements in the 'Reyrolle' range of Metalclad Fittings for Industrial Service. Nearly 200 different types and sizes, covering every possible requirement, are available.

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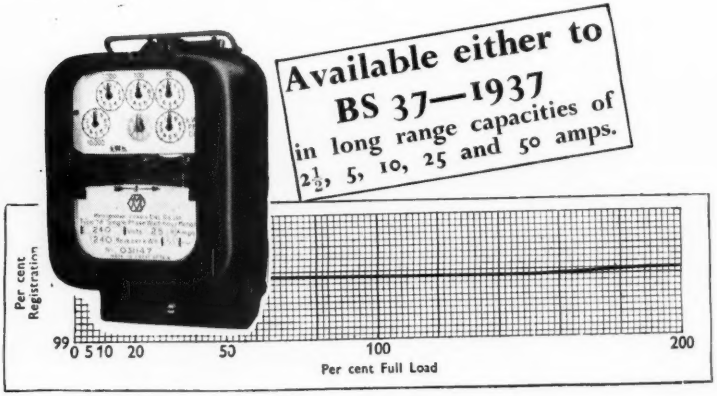
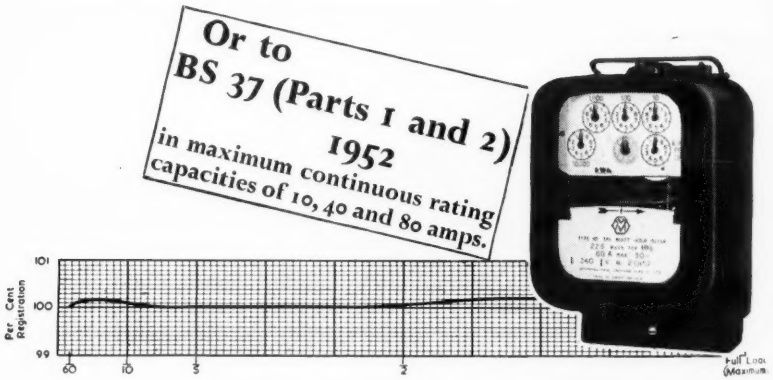
EXETER · LEYTON · MANCHESTER · PECKHAM · TRURO

Metrovick Type NF Meters


Available either to
BS 37—1937
in long range capacities of
2½, 5, 10, 25 and 50 amps.
Per cent Registration
99
0 5 10 20 50 100 200
Per cent Full Load



In designing the Type NF meter Metrovick engineers anticipated the requirements of the 1952 specification, consequently the two patterns are fundamently similar.

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Member of the A.E.I. group of companies

METROVICK *equipment for meticulous metering*

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 18th February, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

2357. Radio Corporation of America.—Cathode-ray tubes. 24th January, 1947. Cognate application 2358, 30th January, 1946. (687561.)

1948

17825. Standard Telephones & Cables, Ltd., and Mayer, S. E.—Electric circuit components. 1st July, 1949. (687475.)

22895. Pye, Ltd., Holland, E. O., and Smith, J. B.—Waveform generator, particularly for television. 26th August, 1949. (687712.) 22896. Television waveform and test signal generator. 26th August, 1949. (687713.)

23043. Lyons & Co., Ltd., J., and Babb, A. T. S.—Electrical testing apparatus adapted for testing the moisture content of substances. 1st September, 1949. (687477.)

31750. Metropolitan-Vickers Electrical Co., Ltd., and Newton, J. M.—Gears and gearing. 6th January, 1950. (687715.)

33666. General Electric Co., Ltd., and Rollin, L.—Circuits which include step-by-step electric switches. 30th December, 1949. (687652.) 33668. Multiple recording instruments. (687653.) 33669. Optical apparatus. (687654.)

1949

1111. British Thomson-Houston Co., Ltd., and Melville, W. S.—Monitoring of radar equipment. 3rd January, 1950. (687775.)

2923. Electro-Hydraulics, Ltd., MacKenzie, M. A., and Burns, R. H.—Electro-hydraulic control system. 4th April, 1950. (687479.)

10288. Electric & Musical Industries, Ltd.—Circuits for focusing cathode-ray beams. 17th April, 1950. (687568.)

11951. Vogt, H.—Electrodes for electric batteries. 4th May, 1949. (687569.)

18340. Electric & Musical Industries, Ltd.—Circuit arrangements for deflecting cathode-ray beams. 29th June, 1950. (687572.)

21013. Standard Telephones & Cables, Ltd.—Waveguide transformers. 12th August, 1949. (687573.)

23981. Smit & Co.'s Transformatoren-Fabriek N.V., W.—Electric tap-changing switch for regulating transformers. 10th October, 1949. (687575.)

33217. Air Reduction Co., Inc.—Gas-shielded electric arc welding. 29th December, 1949. (687666.)

1950

6737. General Electric Co., Ltd., and Allard, L. S.—Circuit arrangements for operating cathode-ray tubes. 19th March, 1951. (687721.)

9294. Electric & Musical Industries, Ltd.—Circuit arrangements for modulating carrier-frequency signals. 5th April, 1951. (687783.)

13994. British Thomson-Houston Co., Ltd., and Castellain, A. P.—Recording of televised images. 31st May, 1951. (687730.)

14156. Normand Electrical Co., Ltd.—Reduction gear units. 4th June, 1951. (687502.)

15755. Soc. Anon pour les Applications de l'Electricité et des Gaz Rares-Etablissements Claude-Paz & Silva.—Electric discharge apparatus with a mercury containing atmosphere. 23rd June, 1950. (687731.)

16018. Sandelec, Ltd.—Dynamo-electric machines. 16th May, 1951. Cognate application 21516, 31st August, 1950. (687591.)

19389. C.A.V., Ltd.—Means for operating gas-discharge lamps from a low-voltage source of direct current. 19th June, 1951. (Addition to 667764). (687511.)

19561. Edison Swan Electric Co., Ltd., and Ansell, K. W.—Electric lighting fittings. 26th April, 1951. (687792.)

21837. Westinghouse Brake & Signal Co., Ltd., and Brackenbury, A. G.—Mechanical control mechanisms. 15th August, 1951. (687515.)

22727. Standard Telephones & Cables, Ltd.—Alternating current comparator. 15th September, 1950. (687600.)

23868. Babcock & Wilcox, Ltd.—Vapour generating and superheating units comprising tubulous superheaters and tubulous reheaters. 29th September, 1950. (687795.)

24808. Berreklouw, D.—Device for measuring the high-frequency resistance of oscillatory circuits in radio apparatus. 11th October, 1950. (687796.)

26307. General Electric Co., Ltd., and Park, K. J.—Electromagnetic induction apparatus having a laminated iron core. 29th October, 1951. (687743.)

26867. Philips Electrical Industries, Ltd.—Oscillation generators with automatic frequency control. 3rd November, 1950. (687602.)

27454. Smith & Sons (England), Ltd., S.—Electrically operated indicators. 9th November, 1951. (687604.)

27544. Tutton, G. O.—Illuminated signs for advertising and like purposes. 5th November, 1951. (687605.)

27827. English Electric Co., Ltd.—Dynamo-electric machines. 9th November, 1951. (687746.)

28050. British Thomson-Houston Co., Ltd., and Rayden, R. G.—Speed control of electric motors. 16th November, 1951. (687799.)

28155. Philips Electrical Industries, Ltd.—Electrical escapement circuits for use in automatic telephone exchange and like systems for numerically positioning group selectors. 17th November, 1950. (687747.)

28356. Bendix Aviation Corporation.—Piezo-electric oscillator. 20th November, 1950. (687748.)

28930. Standard Telephones & Cables, Ltd.—Supports for cable drums. 23rd November, 1951. (687804.)

29389. British Insulated Callender's Cables, Ltd.—Apparatus for use in producing interaction between liquid and gaseous matter. 29th November, 1951. (687806.)

30051. Thompson Bros. (Bilston), Ltd., and Fellows, E.—Electrically driven centrifugal machine. 11th October, 1951. (687680.)

31656. Fioravanti, G.—Machines for making magnetic cores for electrical transformers. 29th December, 1950. (687610.)

1951

523. Philips Electrical Industries, Ltd.—Amplifier circuits. 8th January, 1951. (687683.)

1528. Howey, W. C., and Howey, W. R.—Photo-electric engraving. 19th January, 1951. (687613.)

1931. Fasco Industries, Inc.—Thermostatic electro-magnetic switch assembly. 25th January, 1951. (687614.)

2371. Siemens & Halske Akt.-Ges.—Semi-conductor arrangements. 30th January, 1951. (687755.)

2446. Hotpoint Electric Appliance Co., Ltd.—Electro-plated electrical heating elements. 6th November, 1951. (687535.)

2536. Massons, E. C.—Electromagnetically-operated pump for raising liquids. 1st February, 1951. (687756.)

2659. Lunalamman Aktiebolag.—Electrode for electric low-pressure discharge tubes. 2nd February, 1951. (687617.)

3192. Tourtellier, M.—Travelling electric current collectors or pick-ups. 9th February, 1951. (687757.)

3726. Goudie, N. T. E., and Davies, B. (trading as Scottie Products).—Holder for flexible electric cables. 18th October, 1951. (687695.)

3815. Standard Telephones & Cables, Ltd.—Stabilized electric wave amplifiers. 16th February, 1951. (687540.)

3843. Metropolitan-Vickers Electrical Co., Ltd.—Production of beams of high energy electrons from betatron-started synchrotrons. 16th February, 1951. (687696.)

4672. Musso, G.—High and very high voltage oil circuit breakers. 26th February, 1951. (687627.)

4757. British Thomson-Houston Co., Ltd.—Methyl-substituted disiloxane diols. 27th February, 1951. (687542.)

4767. Soc. Anon. pour l'Industrie de l'Aluminium.—Process for producing molten aluminium by electrolysis of aluminium chloride. 27th February, 1951. (687758.)

5410. British Thomson-Houston Co., Ltd.—Electrodes for supporting electric arcs. 6th March, 1951. (687544.)

8557. Automatic Electric Laboratories, Inc.—Electronic frequency generator. 12th April, 1951. (687632.)

9065. Speed Development Co., Ltd., and Ruffle, W. H. —Fluid-pressure-operated electric switches. 18th April, 1951. (687633.)

10310. Philco Corporation.—Deflection members for cathode-ray tubes. 2nd May, 1951. (687762.)

10394. Philips Electrical Industries, Ltd.—Circuit arrangements for use in automatic signalling systems for engaging a common device. 3rd May, 1951. (687763.)

12676. Westinghouse Electric International Co.—Arc welding apparatus. 30th May, 1951. (687819.)

14131. Radio Corporation of America.—Method and apparatus for forming thin-walled metal sleeves. 14th June, 1951. (687547.)

15389. Impregnation.—Automatic photo-electric control of bath concentrations. 28th June, 1951. (687638.)

15764. British Thomson-Houston Co., Ltd.—Magnetic slip devices. 3rd July, 1951. (687549.)

16088. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 6th July, 1951. (687550.)

17155. Thor Corporation.—Dishwashing machines. 19th July, 1951. (687824.)

17493. Pye, Ltd., Holland, E. O., and Smith, J. B.—Waveform generator, particularly for television. 26th August, 1949. Divided out of 687712. (687769.)

18374. Licencia Talalmanyokat Ertekesito Vallalat.—Method of manufacturing electric condensers. 3rd August, 1951. (687827.)

18907. Akt.-Ges. Brown, Boveri & Cie.—Arrangement for controlling the introduction of charged particles into the circle of equilibrium of a circular accelerator. 10th August, 1951. (687829.)

20143. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Transmission devices comprising an automatically operating overload release clutch. 27th August, 1951. (687554.)

20164. Metropolitan-Vickers Electrical Co., Ltd., and Newton, J. M.—Bearings. 6th January, 1950. Divided out of 687715. (687770.)

20397. British Thomson-Houston Co., Ltd.—Driving mechanism for washing machines and the like. 29th August, 1951. (687831.)

21899. Radio Corporation of America.—Electro-mechanical transducers. 18th September, 1951. (687557.)

27190. Babcock & Wilcox, Ltd.—Tubulous vapour generating and vapour heating units. 20th November, 1951. (687836.)

27642. Heinrich, D. O.—Collecting electrodes for electro-precipitators. 26th November, 1951. (687837.)

27787. British Thomson-Houston Co., Ltd.—Defrost indicators for refrigerators. 27th November, 1951. (687650.)

CANADIAN EXPORTS

Large Increase in First Half of 1952

DURING the first six months of last year Canadian exports of electrical machinery and apparatus were double the value of those shipped in the first half of 1951. The total was $16,798,000. Big increases were recorded in the machinery and radio groups in particular. Outstanding destinations, apart from the United States, were Brazil and some other Latin-American countries. In many lines of Canadian electrical goods sales extended to nearly all the major markets.

Class of Goods	Jan.–June, 1952 $(000)	Inc. or dec. on Jan.–June, 1951 $(000)
Batteries, storage	181	– 214
To Venezuela	80	– 42
Batteries, other	517	+ 118
To Malaya	159	– 162
,, *Indonesia*	153	+ 116
,, *Ceylon*	130	+ 128
Radio receiving sets	690	+ 91
To Peru	44	– 7
,, *Venezuela*	64	– 123
,, *Colombia*	49	+ 36
,, *Philippines*	28	+ 27
,, *United States*	114	+ 11
,, *South Africa*	25	+ 25
,, *Pakistan*	17	+ 13
Radio apparatus, other	4,847	+ 2,814
To United Kingdom	104	+ 100
,, *Brazil*	166	+ 26
,, *United States*	4,402	+ 3,657
Dynamos, generators and parts	1,862	+ 1,394
To New Zealand	27	+ 25
,, *Pakistan*	16	+ 16
,, *Australia*	107	+ 33
,, *Brazil*	1,542	+ 1,341
Telegraph and telephone apparatus	733	+ 425
To Brazil	100	+ 54
,, *United States*	554	+ 336
Motors and parts	1,297	+ 738
To Australia	164	+ 13
,, *New Zealand*	71	+ 55
,, *Venezuela*	52	+ 43
,, *Brazil*	128	+ 58
,, *Colombia*	104	+ 91
,, *United States*	262	+ 136
Transformers and parts	2,161	+ 231
To United States	126	+ 125
,, *Mexico*	116	+ 113
,, *Brazil*	2,168	+ 980
Meters and parts	1,378	+ 191
To Brazil	522	+ 240
,, *Chile*	118	+ 15
,, *Colombia*	65	+ 21
,, *Cuba*	240	– 21
,, *Mexico*	186	– 78
,, *Venezuela*	91	– 22
Spark plugs, magnetos, etc.	985	+ 198
To Switzerland	40	+ 4
,, *Australia*	28	– 8
,, *New Zealand*	18	+ 11
,, *Venezuela*	73	+ 42
,, *South Africa*	186	– 19
,, *Indonesia*	30	– 35
,, *India*	32	– 70
,, *Ceylon*	15	– 1
,, *Belgian Congo*	20	+ 5
,, *Brazil*	167	+ 167
,, *Mexico*	108	– 18
Electrical apparatus, n.o.p.	1,874	+ 656

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—25th March. State Electricity Commission. I.c. engine driven generating sets. (C.R.E. 42494/52. Ten/5425.)*
MELBOURNE.—4th March. State Electricity Commission of Victoria. Supply of 250 compression dead end assemblies for steel cored aluminium conductor. (C.R.E. 43213/52. Ten/5427.)*

Belfast.—30th January. Electricity Department. Supply of electrical stores. (See this issue.)

Blackpool. — 21st January. Corporation. Supply of materials and erection of three illuminated archways. (See this issue.)

Bootle.—24th January. Borough Council. Electrical goods (Sch. 13) and electric lamps (Sch. 14) for one year. Borough surveyor, Town Hall.

Coventry. — 31st January. City Council. Electric lamps for one year. City engineer, Council House.

Egypt.—CAIRO.—24th February. Ministry of Public Works. Diesel generating station near Qaha, Calubia Province. (C.R.E. 42567/52. Ten/5396.)*

Finchley.—26th January. Borough Council. Street lighting equipment. (See this issue.)

Friern Barnet. — 28th January. U.D.C. Street lighting lamps. (See this issue.)

Horbury.—17th January. U.D.C. Electrical installations in 243 houses. T. D. Manning, surveyor, Town Hall.

India.—TRIVANDRUM.—21st January. Stores Purchase Committee, Government of Travancore-Cochin. Supply of a.c.s.r. conductors and accessories. (C.R.E. 42639/52. Ten/5411.)*
NAGPUR.—17th March. Madhya Pradesh Electricity Board. Supply of 400 V, 11 kV and 66 kV switchgear, transformers, cables and accessories for Ballarpur power station. (C.R.E. 43410/52. Ten/5431.)*
NEW DELHI.—20th January. Director General of Supplies and Disposals. Supply of electrically driven pumping sets. (C.R.E. 43693/52. Ten/5443.)*

Iraq. — BAGDAD. — 25th January. Central Foreign Purchase Committee, Ministry of Finance. Supply of 1,000 ceiling fans. (C.R.E. 43111/52. Ten/5416.)*
1st February. Government Development Board. Pumping station machinery for Saklawiya drainage project. (C.R.E. 40350/52. Ten/5415.)

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Kirkby - in - Ashfield. — 17th January. U.D.C. Electric submersible pump. (See this issue.)

London.—WESTMINSTER.—26th January. City Council. Supply of electric lamps, cable, etc., and motor vehicle batteries for one year. Town clerk, City Hall, Charing Cross Road, W.C.2.

New Mills.—28th January. U.D.C. Street lighting equipment. (See this issue.)

Southern Rhodesia. — SALISBURY. — 3rd February. Two 2,000 kVA transformers and five 150 kVA transformers for Umniati "B" power station. (C.R.E. 43184/52. Ten/5446.)*

ORDERS PLACED

Grimsby.—Corporation. Electrical installation work at Chelmsford Avenue Secondary Modern Boys' School (£8,485).—N. G. Bailey & Co., Ltd.

Maidstone.—Corporation Housing Committee. Electrical installations in 10 houses and 24 flats on the Shepway estate (£562).—L. Taylor, Hythe.

Nantwich (Cheshire).—R.D.C. Electrical installations in 74 houses on various sites (£1,914).—Harrison's.

Southgate. — Borough Council Highways Committee. Supply of posts, flashing units, beacons, etc., for the lighting of uncontrolled pedestrian crossings (£15 0 6d per unit).—Gowshall, Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alexandria (Dunbartonshire).—Hospital for Department of Health for Scotland (£400,000); A. M. Macdougall & Co., Ltd., 24, Davaar Street, Glasgow, S.E.

Bellshill.—Tube Mill at Clydesdale Steel Works for Stewarts & Lloyds, Ltd.; Crowley, Russell & Co., Ltd., 16, Blythswood Square, Glasgow, C.2.

Blackpool.—Extensions, Mowbray Drive, for Wasp Engineering Co., Ltd.; Gorst, Crabtree & Denbigh, architects, 7, Birley Street.

Dover.—Houses, flats, etc. (32). Temple Ewell; borough surveyor, Brook House.

Dundee.—Works for T. L. Miller & Co., Ltd.; W. M. Wilson, 61, Meadowside, Dundee.
Radiodiagnostic department at Royal Infirmary; Jas. Deuchars, architect, Blackness Road, Dundee.

Edinburgh.—New medical school at University (£1,500,000); W. N. W. Ramsay, architect, 259, Sauchiehall Street, Glasgow, C.2.

Glasgow.—Extensions for James Howden & Co., Ltd., Scotland Street; Moad & Wallace, 278, St. Vincent Street, Glasgow.

Additions for Scottish Wool Flock Co., Ltd.; W. Crawford & Sons, Ltd., Minorca Street, Glasgow, C.3.

Secondary school at Hallhill for Scottish Education Department; John McNab, 129, Bath Street, Glasgow, C.2.

Extensions at Helen Street for British Oxygen Co., Ltd.; company's own architects.

Additions and rebuilding for James Buchanan & Co., Ltd., Hydepark Street; Architect's Department, Distillers Co., Ltd., 64, Waterloo Street, Glasgow, C.2.

Works at Pinkston Road for Twisteel Reinforcement, Ltd., 43, Upper Grosvenor Street, London, W.1; James Taylor & Co., 196, West Regent Street, Glasgow, C.2.

Greenhithe.—Flats (12), Knockhall Road; Swanscombe U.D.C. surveyor.

Greenock.—Large factory, Kip Valley, for Scottish Industrial Estates, Ltd., 3, Woodside Place, Glasgow, C.3; Crowley, Russell & Co., Ltd., 16, Blythswood Square, Glasgow, C.2.

Factory at Spango Valley; Boswell, Mitchell & Johnston, architects, 256, West George Street, Glasgow, C.2.

Additions to foundry (£14,000) and Cardsburn Dockyard; Scotts' Shipbuilding & Engineering Co., Ltd.

Hemel Hempstead. — Dwellings (116), Apsley-Bennetts End, for Development Corpn.; C. Miskin & Son, Ltd., Romeland, St. Albans.

Kilmarnock.—Extensions for Massey-Harris, Ltd., at industrial estate; Beveridge & Dallachy, 248, West George Street, Glasgow, C.2.

Liverpool.—Extensions, Mill Lane, for J. H. Robinson & Co. (Liverpool), Ltd.; John Williams (Liverpool), Ltd., 70, Collingwood Street, Liverpool.

Lunesdale.—Houses at Caton (30) and Halton (18); R.D.C. surveyor.

Manchester.—Two-storey clothing factory at Lord Street, Cheetham, for Mark Doniger (Manchester), Ltd., 32, Deansgate, Manchester.

Middlesbrough.—Completion of partly-built cinema in Longlands Road for Thompson's Enterprises, Ltd., Palladium Buildings, Middlesbrough (£20,000).

Houses (92), Park End site; borough engineer.

Mill Hill.—Houses (130), Lawrence Street; A. W. Curton, Ltd., Stone Grove, Edgware.

Newcastle - on - Tyne. — Conversion of Jesmond Dene House into girls' boarding school; city architect, 18, Cloth Market, Newcastle.

Extensions to works, Industry Road, for Jackson Associated Manufacturers, Ltd.; Stephenson & Gillis, Saville Row, Newcastle.

Northumberland.—Conversion of Gallowhill Hall into school for subnormal children; county architect, County Hall, Newcastle-on-Tyne.

Oldbury. — Secondary modern school at Brandhall; R. Y. Logan, director of education, Castle Street, Worcester.

Old Fletton (Hunts).—Houses (88), Chapel Street site, Stanground; U.D.C. architect, Old Fletton, Peterborough.

Houses (121), Stanground; Southfields Estates, Ltd.

Oswaldtwistle.— Dwellings (119), Tottington Road; T. D. Manning, architect, Council Offices.

Oxfordshire. — Schools at Ambrosden and Marston; county architect, 3, Beckett Street, Oxford.

Peterborough.—Houses (15), for old people at Eye and twelve 3-bedroomed houses at Maxey; architect to Rural District Council.

Peterlee.—Houses (260) for Peterlee Development Corporation, Shotton Hall, Castle Eden, Co. Durham; W. J. Scott, chief architect.

Prescot.—Flats (14), Scotchbarn estate, for U.D.C.; Martin Cowley, Ltd., Clay Cross, Derbys.

Reading.—Laboratory, Christchurch Road; Milk Marketing Board.

Scarborough.—Secondary modern school on Eastfield estate for North Riding E.C.; Gollins, Melville & Ward, architects, 15, Manchester Square, London, W.1.

Smethwick.—New factory and offices; Midland Motor Cylinder Co., Ltd.

Works extensions proposed; Mansill Booth & Co., Cape Stamping Works.

Stowmarket.—Church, for Congregational authorities (£45,000); Sadler & Sons, builders, Richmond Road, Ipswich.

Stretford. — St. Margaret's R.C. School; Greenhalgh & Williams, architects, Mawdsley Street, Bolton.

Sunderland.—Flats for 300 families; N. Bishop, borough architect, Grange House, Stockton Road.

Community centre, Pennywell estate; borough architect.

Surbiton.—Factory extensions, Hook Rise; Royston Engineering Co., West Molesey, Surrey.

Thornaby - on - Tees. — Proposed vehicle maintenance depot and garage at Bonlea Foundry for T. Allan & Sons; G. P. Stainsby, architect, 57, High Street, Stockton.

Tottenham.—Flats (12), Forster Road; L. R. Lacey, 39, Lansdown Road, N.17.

Waltham Holy Cross.—Houses (37), on Paternoster Hill estate, Upshire, for U.D.C.; H. J. Chapman, clerk, Town Hall, Waltham Abbey, Essex.

Warrington.—First instalment of College of Technology (£400,000); borough engineer.

Wigan. — Rehabilitation and physiotherapy department at Royal Albert Edward Infirmary for Manchester Regional Hospital Board; Thos. Worthington & Sons, architects, Oxford Road, Manchester.

Temporary county primary school at Pemberton; borough engineer.

Wirksworth. — Houses (40), Derby Road estate; J. Bakewell, architect, 25, Chapel Street, Belper.

Wolverhampton. — Retail market, Brick Kiln Croft site (£250,000); town clerk, Town Hall.

Extensions, Woden Road, for Park Engineering Co., Ltd.; F. Clark, architect, Whitmore Street, Wolverhampton.

Wrexham. — Victory Commemoration Hall; Stephenson Young & Partners, architects, 6, Bluecoat Chambers, Liverpool.